

Social Competence Outcomes of Children Prenatally Exposed to Methadone, aged 9.5 Years

A thesis submitted in partial fulfilment of the requirements for the degree

of Master of Arts in Psychology

By Emma Adrianne Jordan

University of Canterbury

2018

ACKNOWLEDGEMENTS

The completion of my thesis would not have been possible without the help, support, and encouragement of others. First, I would like to thank my primary supervisor Dr Jacki Henderson. I am grateful for the time and effort Jacki has put into my thesis, and for the unique opportunity of working on such an important study. I would also like to thank my other supervisor, Dr Virginia McIntosh, for all her input, excellent critiquing skills and knowledge of EndNote.

A big thankyou to the Canterbury Child Development Research Group: Marie Goulden, Karelia Levin, Sam Lee, and Sophia Bennetts. Thank you for your advice, encouragement, and support. I have thoroughly enjoyed working with you all. I would also like to acknowledge Professor Katharina Naswall and Matt Ward, who provided much needed help and guidance in conducting the statistical analyses of my thesis.

Researching the development of children has highlighted the importance of early experiences. Thank you mum and dad for giving me the best start in life possible and always being loving and supportive of whatever I choose to do. I would also like to thank my fiancé Gary for always making me laugh and providing an alternative perspective.

Lastly, I would like to thank all the children and their families for taking part in this research, making the completion of this thesis possible. I have thoroughly enjoyed my two years as a member of the Canterbury Child Development Research Group and appreciate the opportunity to learn about the development of children.

ABSTRACT

Research suggests prenatal exposure to methadone is associated with increased risk of adverse neurological and developmental impairments. Presently, there is limited evidence on the effects of prenatal methadone exposure on children, particularly beyond infancy and early childhood. The current study aimed to address this gap in the field of prenatal methadone exposure and later developmental outcomes by comparing the social competence of 9.5 year old children born to opioid dependent mothers who were maintained on methadone throughout pregnancy with a group of non-exposed children. An additional aim was to assess the effects of primary caregiver and environmental psychosocial risk factors on children's social competence outcomes.

Seventy five children prenatally exposed to methadone and 96 non-exposed children were followed prospectively from birth until age 9.5 years. At age 9.5 years, all children participated in a comprehensive neurodevelopmental assessment. As part of that assessment the primary caregiver for each child completed a series of questionnaires, one of which examined social competence, The Behaviour Assessment System for Children, Second Edition. Psychosocial predictors were collated from the maternal comprehensive interview at term and at the 9.5 year follow-up.

At age 9.5 years children prenatally exposed to methadone were rated by primary caregivers as displaying higher levels of externalising ($p < .001$), internalising ($p < .001$), and interpersonal social behaviour problems ($p < .001$) compared to non-exposed children. Methadone-exposed children were more likely to be hyperactive, aggressive, have a conduct problem and higher depressive symptomatology, be socially withdrawn, lack social skills, and unable to communicate efficiently and regulate their emotions than their non-exposed peers. Maternal depressive symptomatology at the time of their child's birth ($p_{\text{externalising}} = .009$, $p_{\text{interpersonal}} = .002$) and caregiver instability ($p_{\text{externalising}} = .008$, $p_{\text{interpersonal}} = .006$) were

significant predictors of externalising behaviour and interpersonal social behaviour outcome at age 9.5 years.

Findings from the current study provide new evidence into the social competencies of children prenatally exposed to methadone. By age 9.5 years, a greater number of methadone-exposed children displayed poor social competence across the two domains tested, emotional and behavioural adjustment and interpersonal social behaviour, than their non-exposed peers. Prenatal methadone exposure, caregiver instability, and perinatal maternal depressive symptomatology successfully predicted externalising and interpersonal social behaviour outcome. These findings raise concerns regarding the impact prenatal exposure to methadone and adverse psychosocial risk factors have on a child's developing social competence, and highlight the importance for the provision of support and interventions for these children and their parents.

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LIST OF ABBREVIATIONS

BASC-2	Behaviour Assessment System for Children, Second Edition
CBCL	Child Behaviour Checklist
CFA	Confirmatory factor analysis
CFI	Comparative fit index
EPDS	Edinburgh Postnatal Depression Scale
MDI	Mental Development Index
ME	Methadone-exposed
NAS	Neonatal abstinence syndrome
Non-ME	Non-methadone-exposed
OST	Opioid substitution treatment
RATC	Roberts Apperception Test for Children
RMSEA	Root mean square error of approximation
SBIS	Stanford-Binet Intelligence Scale
SES	Socio-economic status

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CHAPTER 1

Introduction

Opiate use is a significant global issue. A recent report released from the United States estimates 0.4% of the world's population aged between 15 and 64 years, 17 million individuals, use opiates annually (United Nations Office on Drugs and Crime, 2016). A large proportion of these users are of reproductive age. This is of concern as living with an addicted caregiver can negatively impact children's development across multiple domains (Ministry of Health, 2014). These negative consequences are thought to arise due to adverse health conditions and social experiences the child is exposed to, which are often strongly associated with illicit drug use (Ministry of Health, 2014).

Prenatal exposure to opiates has been shown to increase the risk of neurological and developmental impairments. In addition to physical, motor, and cognitive delays (Rosen & Johnson, 1982; Straus, Hamby, Finkelhor, Moore, & Runyan, 1998; Wilson, Desmond, & Wait, 1981), prenatally exposed children are shown to display socio-emotional and behavioural difficulties (de Cubas & Field, 1993; Hunt, Tzioumi, Collins, & Jeffery, 2008). These impairments will be detailed in later sections of this thesis.

Despite evidence suggesting children exposed to opiates are at an increased risk of a range of neurodevelopmental delays and difficulties, existing research primarily focuses on the neonatal and early childhood period. Additionally, a lack of research exists examining the social competence, or social development of children exposed to opiates. Further research within this area is vital as the development of social competence plays an important role during childhood, with deficits shown to affect present and future functioning (Rose-Krasnor, 1997; Woodward & Fergusson, 2000).

Very little is known about the behavioural adjustment and interpersonal social behaviours of school-aged children prenatally exposed to methadone. To date only one study has

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examined the social and emotional development within this population (de Cubas & Field, 1993). This thesis aims to address this gap in existing research through the examination of two social competence domain outcomes, emotional and behavioural adjustment, and interpersonal social behaviour, of children born to mothers maintained on methadone throughout pregnancy.

1.1 Opiate Mechanisms and Opiate Dependency

Opiates are a class of drug derived from opium poppy and include the commonly known drugs heroin, morphine, and codeine (Barceloux, 2012; Deering et al., 2008). Opiates are powerful analgesics, inhibiting the transmission of pain throughout the user's body while simultaneously exerting a euphoric effect (Barceloux, 2012). Frequent use of opiates builds a tolerance to the drug's effects whereby increased dosages are required to maintain the 'high' elicited, and continued administration is necessary to avoid withdrawal symptoms (Barceloux, 2012).

Withdrawal symptoms are characteristically unpleasant effects that occur when a drug is abruptly removed from a user's system (Franck, Naughton, & Winter, 2004). Withdrawal symptoms predominately manifest in four ways: hyperirritability and dysregulation of the autonomic nervous system, including behaviours such as sneezing and sweating; gastrointestinal dysfunction; respiratory issues; and abnormal motor movements, such as tremors and repetitive movements (Franck et al., 2004). It is believed that due to the sense of euphoria one feels when using opiates, and in combination with increased tolerance and harsh withdrawal symptoms (Barceloux, 2012; Franck et al., 2004), users are at an increased likelihood of recurrent use, resulting in addiction.

1.2 Prevalence of Opiate Use

Recent statistics of opiate use from the United States (United Nations Office on Drugs and Crime, 2016) reflect trends from New Zealand (Adamson et al., 2012). In 2008, the New

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Zealand Ministry of Health (Deering et al., 2008) released a report stating approximately 10,700 New Zealanders had engaged in weekly licit or illicit substance abuse the previous year, with an estimated 9,000 New Zealanders experiencing clinical opioid dependence (Adamson et al., 2012; Deering et al., 2008). In their sample of 6,500 New Zealanders, the Ministry of Health (2010) reported that four percent of individuals aged between 16 and 64 years had engaged in opiate use at least once in their lifetime, with use peaking between age 25 to 34 years. If this statistic is truly representative of the New Zealand population, at any given time 94,000 New Zealanders will have misused an opiate.

Opiate misuse and addiction has significant individual and societal impact. Individuals who are dependent on opiates are at elevated risk of engaging in criminal activity, unemployment, maintaining a poor quality of life, and financial issues (Deering et al., 2008). Furthermore, opiate dependent individuals are at a significantly higher risk of mental health related problems such as depression, anxiety, and personality disorders (Davie-Gray, Moor, Spencer, & Woodward, 2013). Other health concerns include increased exposure to blood-borne diseases such as Human Immunodeficiency Virus (HIV), Hepatitis B and Hepatitis C, sexually transmitted diseases, fatal overdose, poly-substance abuse, and poor nutritional behaviours (Cleary et al., 2012; Johnson, Gerada, & Greenough, 2003; Thaithumyanon, Limpongsanurak, Praisuwanna, & Punnahitanon, 2005; Vucinovic et al., 2008).

1.3 Methadone Maintenance Treatment

In an attempt to decrease the prevalence of heroin abuse and the risks associated with a drug dependent lifestyle, methadone was introduced in the 1960's as a drug treatment option (Johnson et al., 2003; Joseph, Stancliff, & Langrod, 2000). Methadone is a synthetic and long-lasting opioid agonist which binds to the μ -opioid receptor, and exerts morphine-like effects, similar to the effects of heroin (Farid, Dunlop, Tait, & Hulse, 2008; Joseph et al., 2000; Krans et al., 2016; Somogyi, Barratt, Ali, & Coller, 2014). Due to a longer half-life,

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methadone minimises the symptoms of withdrawal and drug cravings, which in turn decreases an individual's drug seeking behaviours (Cleary et al., 2012; Farid et al., 2008; Somogyi et al., 2014). Additionally, methadone consumption at therapeutic doses does not result in euphoric and analgesic effects, allowing the individual to continue with their daily life (Dole, 1988).

Methadone Maintenance Treatment is the preferential treatment option for individuals with an opiate dependence (Farid et al., 2008). Presently, methadone is one of the opioid substitution treatment (OST) options available for New Zealanders with an opiate dependency (Adamson et al., 2012; Ministry of Health, 2014). An estimated 5,000 individuals are currently enrolled in and receiving treatment (Deering et al., 2011). A group of individuals who are at increased risk of adverse outcomes from opiate addiction are pregnant women and their unborn babies. Therefore, it is highly recommended that all pregnant opiate addicts enrol and actively participate in OST's (Laslo et al., 2017).

1.4 Methadone Maintenance Treatment and Pregnancy

An estimated 90% of women who abuse drugs are of reproductive age (Vucinovic et al., 2008), thought to result from the peak in opiate use between the ages of 25 and 35 years (Ministry of Health, 2010). This is cause for concern as adverse health outcomes associated with a high-risk lifestyle observed in non-pregnant women are equally seen in the drug abusing pregnant population (Vucinovic et al., 2008). In addition to health problems outlined previously, during pregnancy opiate addicted mothers and their unborn babies are at increased risk of additional complications. Prenatal exposure to opiates increases risk of spontaneous abortion, perinatal morbidity and mortality, premature delivery, infection, neonatal abstinence syndrome (NAS), low birth weight, congenital abnormalities, and risk of sudden unexpected death in infancy (Dryden, Young, Hepburn, & Mactier, 2009; Hunt et al., 2008; Johnson et al., 2003; Laslo et al., 2017; Sinha et al., 2001; Stevens, Heffner, Flaugh,

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& Mohan, 2017; Thaithumyanon et al., 2005). Due to the risk of complications during and post pregnancy OST is advocated for pregnant women.

Methadone, an opioid substitute available to opiate addicted individuals, has been shown to stabilise the intrauterine environment and reduce the risk of obstetric complications (Deering et al., 2008; Farid et al., 2008). Pregnant women who actively engage in OST are more likely to access antenatal care, and enrolment in OST is associated with decreased rates of preterm delivery and low birth weight (Cleary et al., 2012; Finnegan, 1978). Further benefits include a lower likelihood of relapse (Johnson et al., 2003), increased nutrition, and decreased likelihood of passing over infectious diseases to the infant such as HIV or hepatitis (Joseph et al., 2000).

1.5 Developmental Outcomes of Children Prenatally Exposed to Methadone

1.5.1 Foetal. Despite maternal benefits of methadone consumption during pregnancy compared to ongoing illicit opiate use, growing evidence suggests prenatal exposure to methadone increases the risk of adverse neurological and developmental outcomes for the unborn infant (Behnke, Smith, & Committee on Substance Abuse, 2013; Hunt et al., 2008; Woudes, Roberts, Pryor, Bagnall, & Gunn, 2004; Yanai et al., 2003). Recent animal and human-based data demonstrate administration of synthetic or semi-synthetic opiates may adversely affect foetal brain and central nervous system development, particularly during the first and second trimesters (Yanai et al., 2003). While exposure during the foetal stage appears to have subtle effects on the developing infant, such as restricted growth; exposure during the embryonic stage has shown to have significant teratogenic effects (Behnke et al., 2013). Despite human experimental studies not being possible, observational studies suggest prenatal methadone exposure may negatively affect foetal movement, growth, and development (Dryden et al., 2009; Hunt et al., 2008; Jansson et al., 2011; Woudes et al., 2004). For example, through the use of ultrasound methadone-exposed infants are shown to

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display abnormal foetal activity through a decrease in movement and breathing rate, correlating with the mother's daily dose of methadone (Jansson et al., 2011; Woudes et al., 2004).

1.5.2 Neonatal. Compared with infants born to non-opiate-dependent mothers, infants born to mothers maintained on methadone throughout pregnancy are at elevated risk of premature birth; lower than average birth weight, length, and head circumference; and sudden unexpected death in infancy (Hunt et al., 2008; Johnson et al., 2003; Kenner & D'Apolito, 1997; Soepatmi, 1994; Stevens et al., 2017; Woudes & Woodward, 2010).

Many studies have focused on the infants' resulting addiction to methadone and subsequent withdrawal experienced. Neonatal abstinence syndrome (NAS) is the presentation of intense withdrawal symptoms displayed by neonates shortly after birth due to central nervous system disturbance (Johnson et al., 2003; Stevens et al., 2017). Infants can experience a range of neurological, gastrointestinal, and autonomic dysregulation symptoms which manifest as uncontrollable external behaviours. These symptoms can include tremors, irritability, poor feeding, vomiting, and respiratory distress (Huestis & Choo, 2002; Kocherlakota, 2014). An estimated 50-90% of infants prenatally exposed to methadone experience NAS symptomology and may require pharmacological treatment for extended periods of time (Bandstra, Morrow, Mansoor, & Accornero, 2010; Joseph et al., 2000; Woudes & Woodward, 2010).

1.5.3 Infant/toddler. While neonatal research reports consistent associations between prenatal methadone exposure and physical measurements at birth, whereby infants prenatally exposed to methadone are on average smaller than infants with no prenatal exposure (Hunt et al., 2008; Johnson et al., 2003; Kenner & D'Apolito, 1997; Soepatmi, 1994; Stevens et al., 2017; Woudes & Woodward, 2010), follow up studies suggest methadone-exposed infants 'catch up' in their growth patterns (Hunt et al., 2008; Kenner & D'Apolito, 1997; Soepatmi,

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1994). By two years of age only difference in height separate exposed infants from non-exposed infants (Hans, 1989; Kenner & D'Apolito, 1997; Soepatmi, 1994).

Other studies have examined the motor development of exposed children. While preliminary studies conducted during infancy suggest subtle or no differences between exposed and non-exposed toddlers (Hans, 1989; Hunt et al., 2008; Rosen & Johnson, 1982; Straus et al., 1998; Wilson et al., 1981), follow up studies suggest significant impairments in fine and gross motor skills by 24 months (Hans, 1989) and three years (Hunt et al., 2008). This is suggestive of slower development of motor skills over time in methadone-exposed children.

Research investigating the cognitive development of prenatally exposed toddlers reports contrasting conclusions. Long-term outcomes reportedly range from non-existent or mild, to severe cognitive deficits. In their case-control study Hunt et al. (2008) reported significant group differences between methadone-exposed and non-exposed infants on the Mental Development Index (MDI) from the Bayley Scales of Infant Development (Bayley, 1969) at 18 months, where exposed children received lower scores than non-exposed children. This difference was further evident in the follow-up assessment at 3.5 years where exposed children obtained significantly lower IQ scores on the Stanford-Binet Intelligence Scale (SBIS; Roid, 2003) as well as significantly lower scores on the verbal comprehension and expressive language scales of the Reynell Developmental Language Scales (Reynell, 1977). Further support for differences in cognitive functioning was reported by Rosen and Johnson (1982), who reported that while methadone-exposed children scored within the normal range on the MDI at six, 12, and 18 months, their MDI scores were significantly lower than non-exposed children. Collectively, these findings suggest children prenatally exposed to methadone experience cognitive deficits.

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Research within the area of infant and toddler social and emotional development is sparse. Only one recent study has examined the impact prenatal methadone exposure has on children's subsequent social and emotional functioning. In their study of 133 methadone-exposed and 103 non-exposed comparison toddlers, Hunt et al. (2008) used the Vineland Social Maturity Scale (VSMS) to assess primary caregiver reports of child social maturity at 18 months and three years (50% retention). Analyses revealed that methadone-exposed toddlers received significantly lower scores on the VSMS compared to non-exposed comparison toddlers at both time points ($p < .05$). These findings are suggestive of a persistent pattern of deficit in the social and emotional functioning within this population.

1.5.4 School age. To date only one study has assessed and reported on the development of school age children born to mothers maintained on methadone throughout pregnancy. de Cubas and Field (1993) assessed the cognitive, social, and emotional areas of development in 20 methadone-exposed and 20 non-exposed children aged six to 13 years. No statistically significant between group differences were found on the SBIS or the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983), although methadone-exposed children obtained lower IQ scores.

de Cubas and Field (1993) further reported an association between prenatal methadone exposure and later behavioural development, reporting methadone-exposed children as scoring significantly higher on measures of aggression, anxiety, rejection, and maladaptive outcome than comparison children. Taken together, de Cubas and Field's (1993) findings suggest prenatal exposure to methadone may affect children's future social and emotional functioning. However, due to the small sample size, further replication is required.

1.6 Chapter Summary

Methadone is the current recommended treatment option for opiate addicted pregnant women. Methadone is associated with reduced risks for the mother and unborn infant

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compared to illicit opiate use due to the stabilisation of the uterine environment, increased monitoring throughout pregnancy, and better growth outcomes of exposed infants. However prenatal methadone use is not without its risk on infant development. Compared with non-exposed infants, methadone-exposed infants are more likely to be born premature, smaller, and at risk of NAS (Cleary et al., 2012; Deering et al., 2008; Farid et al., 2008). Further, methadone-exposed toddlers are on average shorter (Hans, 1989; Kenner & D'Apolito, 1997; Soepatmi, 1994), have poorer fine and gross motor skills (Hans, 1989; Soepatmi, 1994), lower IQ scores (Hunt et al., 2008; Rosen & Johnson, 1982), poorer verbal language and communication (Steinhausen, Blattmann, & Pfund, 2007; van Baar & de Graaff, 1994), and are less socially developed (Hunt et al., 2008) than non-exposed children.

A lack of research exists investigating the school-aged outcomes of children born to mothers maintained on methadone during pregnancy. Further research is vital to understand the specific developmental needs of a child prenatally exposed to methadone. Specifically, the social and behavioural outcomes of these children warrant attention as deficits in social development during childhood adversely affects later adolescent and adult outcomes (Rose-Krasnor, 1997; Woodward & Fergusson, 2000).

CHAPTER 2

Social Competence

Social competence plays an important role in an individual's development and functioning. As a basic definition, social competence relates to an individual's ability to effectively function within social settings (Cavell, 1990). Skills obtained and developed through early social interactions and experiences influence later domains in life including social, educational, and employment functioning (Domitrovich, Durlak, Staley, & Weissberg, 2017; Jones, Greenberg, & Crowley, 2015; Moffitt et al., 2011; Rose-Krasnor, 1997; Woodward & Fergusson, 2000). Specifically, underdevelopment of social competence during

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childhood is associated with educational underachievement, poor social interactions, peer rejection, and internalising and externalising behaviours, with these difficulties shown to persist into adolescence and adulthood (Domitrovich et al., 2017; Jones et al., 2015; Rose-Krasnor, 1997). For example, individuals may experience difficulties within intimate partner relations, familial and occupational functioning, and employment opportunities (Woodward & Fergusson, 2000), and engage in increased levels of aggressive, delinquent, and substance abusing behaviours (Moffitt et al., 2011).

Despite the reported influence social competence has on individuals' present and future functioning, a lack of research exists addressing this area in children prenatally exposed to methadone. In research using similar populations, an increased risk of deficits in social functioning is reported (Bada et al., 2012; de Cubas & Field, 1993; Hunt et al., 2008; Nygaard, Slinning, Moe, & Walhovd, 2016; Ornoy, Segal, Bar-Hamburger, & Greenbaum, 2001; Sarfi, Sundet, & Waal, 2013; Soepatmi, 1994) warranting concern and attention.

2.1 Social Competence Defined

Social competence is a broad multidimensional construct resulting in the definition of social competence varying widely across research. Despite diverging definitions, social competence is commonly thought to reflect the extent an individual can effectively function within social relationships and situations (Cavell, 1990; Rose-Krasnor, 1997). As such, a social competent child is thought to be able to make and maintain quality friendships, relate well to others, is well-liked and socially accepted, and is able to utilise and effectively implement interpersonal skills required for social interaction (Rose-Krasnor, 1997). Appropriate interpersonal skills include the ability to regulate and control emotions, negotiate, take another's perspective and social problem solve; adapt behaviour to meet social expectations; and be social cooperative and flexible (Domitrovich et al., 2017; Han & Kemple, 2006; Rose-Krasnor, 1997).

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Competencies exhibited by a socially competent individual include the display of prosocial behaviours, active listening, turn taking, recognising social cues, understanding the difference between intentional and accidental actions, and possessing the ability to initiate and remain engaged in conversation (Halle & Darling-Churchill, 2016; Han & Kemple, 2006; Rose-Krasnor, 1997). A developing social competence can be influenced by an individual's level of competence within other developmental domains including emotional, cognitive, self-regulation, and executive function (Han & Kemple, 2006; Rose-Krasnor, 1997), as well as by external factors such as attachment and parent-child interactions (Rispoli, McGoey, Koziol, & Schreiber, 2013).

When evaluating the overall social competence of a child, studies often report on a single aspect or a small set of domains of social functioning rather than social competence as a whole. Areas or competencies often examined span peer interactions (Altay & Güre, 2012; Anthony et al., 2005), externalising and internalising behaviours (Anthony et al., 2005; Pope & Ward, 1997), social withdrawal (Diener & Kim, 2004; Pope & Ward, 1997), socio-emotional skills (Rispoli et al., 2013), interpersonal social behaviours (Lewallen & Neece, 2015; Rispoli et al., 2013), social cognition (Symons, 2004) and prosocial behaviour (Diener & Kim, 2004; Pope & Ward, 1997). The examination of a single domain of social competence may result in the underestimation of an individual's true level of social competence held, thus affecting the predicted developmental trajectory of the individual. For example, an individual who displays high levels of hyperactive behaviour (behavioural adjustment domain) may not experience peer rejection to the same extent as an individual who displays high levels of hyperactive behaviour and poor emotional regulation (emotional regulation domain).

However, some studies adopt an inclusive perspective in the assessment of social competence, highlighting the importance of a broader approach in the examination of social

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competence, as well as the interconnectedness of the domains of social competence. For example, a study examining the social competence of kindergarten children aged between two and five years examined a range of interpersonal social skills including cooperation, assertion, self-control, and internalising and externalising behaviours (Vahedi, Farrokhi, & Farajian, 2012). Teacher reported analyses revealed that kindergarten children who had poorer social skills displayed concurrent behavioural difficulties.

A further study providing evidence for the adoption of a broader conceptualisation of social competence is by Blair, Denham, Kochanoff, and Whipple (2004) who examined multiple domains of social competence in their sample of preschool aged children. Domains included emotional regulation, internalising and externalising behaviours and interpersonal social skills (providing comfort, assistance and taking another's point of view). Parent and teacher reported analyses suggested the emotional regulation strategies utilised and implemented by children were predictive of internalising and externalising behaviour outcomes. While these studies come together to suggest a broader approach in the evaluation and assessment of social competence allowing for a more in-depth understanding of the social abilities of an individual, a lack of consensus exists around which aspect of social competence are to be examined.

2.2 Conceptual Models of Social Competence

Given the multi-dimensional and complex nature of social competence (Cavell, 1990) and the diverging definitions, many conceptual models have been proposed and developed. One such model is the tri-component model developed by Cavell (1990). The tri-component model consists of three separate levels that are hierarchically linked. Each of the levels informs the other and together the levels encompass social competence: social skills, social performance, and social adjustment (Cavell, 1990; Ritchie, Bora, & Woodward, 2015).

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Social skills form the underlying foundation for effective social competence. Within this model, a broad range of skills are theorised to be indicative of effective social behaviour. Skills include, but are not limited to: socio-cognitive skills, such as theory of mind; and interpersonal skills, such as compliance and encouragement (Ritchie et al., 2015). The level of skill held by an individual at this level is theorised to determine how aptly one functions at the higher levels. For example, the level of skill held in expressing encouragement and cooperation will influence the likelihood of a successful interaction with others (social performance).

Social performance, the middle component in the hierarchy, relates to an individual's ability to utilise and display appropriate interpersonal behaviour within social interactions (Cavell, 1990). Individuals who are successful in social performance display prosocial behaviour and have positive social interactions (Cavell, 1990; Ritchie et al., 2015). Social adjustment forms the top of the hierarchy and relates to an individual's ability to achieve social development goals (Cavell, 1990). Social development goals can include maintaining high quality friendships, the demonstration of leadership behaviours, low peer related difficulties, and low levels of social withdrawal.

A second conceptual framework is that of Hood (2009) adapted from Gurtman's Circumplex Model of Social Competencies (Gurtman, 1999). Gurtman's (1999) model conceptualises social competence as a global construct comprising a range of competencies which fit into eight categories: dominance, extraversion, friendliness, deference, submission, avoidance, hostility, and exploitation. Gurtman (1999) posits each category is interrelated and emphasises the importance of employing a broader approach in the analysis of social competence. Hood (2009) identified an important shortcoming of Gurtman's model whereby two commonly acknowledged domains of social competence, social cognition and emotional regulation, were excluded. In response to this, Hood (2009) proposed her own conceptual

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framework based on four key developmental domains commonly acknowledged in existing literature and theory as indicative of social competence. These domains include emotional regulation, behavioural adjustment, interpersonal social behaviour, and social cognition (see Figure 2.1). Similar to Gurtman's (1999) model, each domain is interrelated, however the extent of overlap is not assumed.

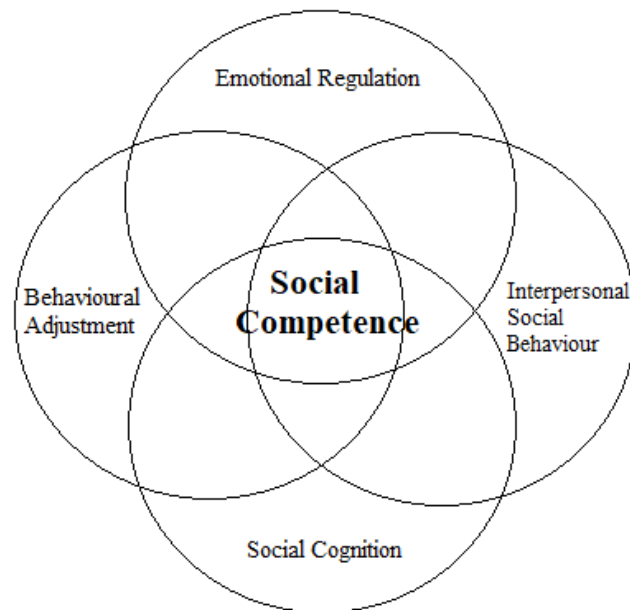


Figure 2.1. Hood's (2009) Proposed Conceptual Framework of Early Social Competence

Each of the conceptual models of social competence discussed above stresses the importance of adopting a broad approach in the examination of social competence, as well as the highly interrelated nature of each domain or aspect traditionally thought to be associated with social competence. The conceptual framework for the measurement of social competence utilised in the current thesis is adapted from Hood's (2009) conceptual framework. The model used in this thesis is illustrated in Figure 2.2 and includes two of the four domains proposed by Hood (2009): behavioural adjustment and interpersonal social behaviour. Domains of emotional regulation and social cognition were not evaluated in the current thesis as the data from which the current study drew did not examine these domains.

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The current thesis adapted model from Hood's (2009) conceptual framework of social competence for multiple reasons. First, Hood (2009) does not assume any degree of interrelatedness between the four domains analysed. Second, the model adopts an inclusive nature in the evaluation of social competence. Third, measures of social competence examined by the Canterbury Child Development Research Group mapped onto Hood's (2009) conceptual framework.

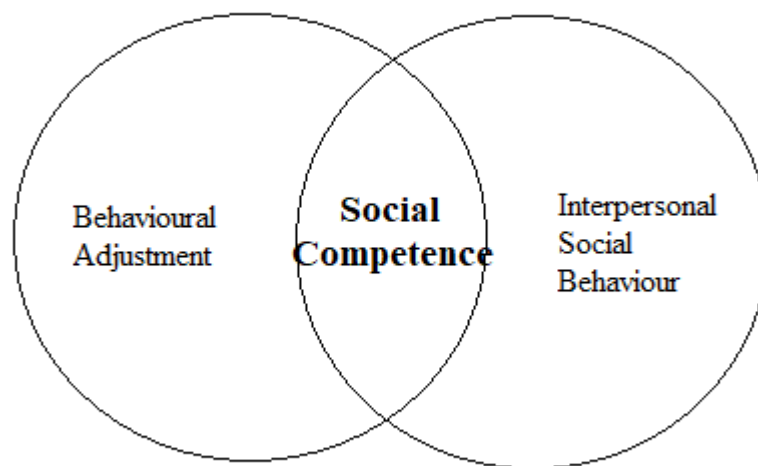


Figure 2.2. Proposed Conceptual Developmental Framework of Social Competence

2.3 Social Competence of Methadone-Exposed Children

To identify existing studies concerned with the social competence of children prenatally exposed to methadone, an extensive database search was conducted. Pertinent studies were identified through systematic searching of PsycINFO, PubMed, ScienceDirect, and Google Scholar. A database search was carried out using the following terms each sequentially and in combination: *prenatal, in utero, exposure, methadone, opioid, opiate, consequence, social competence, social, development, functioning, methadone maintained, and mother*. Selected papers met the following criteria: presented empirical research, participants were prenatally exposed to methadone, participants were school-aged, and included outcome measures which assessed domains of social competence. Both longitudinal and cross-sectional studies were

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included. Using these criteria, one study was identified. Due to sparsity of existing research on the social competence of methadone-exposed children, inclusion criteria were broadened to include opiate and opioid-exposed samples, increasing the number of studies selected to six.

Tables 2.1 and 2.2 present findings from published research examining the effects of prenatal exposure to opiates on the social competence outcomes of school-aged children. For ease of interpretation, studies are reviewed in two parts. First, the social and emotional adjustment outcomes are reviewed, followed by studies examining behavioural outcomes.

2.3.1 Social and Emotional Adjustment of Children Prenatally Exposed to Opiates. A cross-sectional study conducted by de Cubas and Field (1993; see Table 2.1) is the only study included in the current review examining solely methadone-exposed (ME) school-aged children. de Cubas and Field (1993) examined a range of developmental outcomes of children born to methadone maintained mothers, one of which was social and emotional development. Twenty ME mother-child dyads were recruited at random through a local methadone treatment programme. A non-exposed comparison group of 20 mother-child dyads were selected from the Development Evaluation Clinic where study children went for their wellness check-ups. Children were aged between six and 13 years at assessment. Groups were matched for age, sex, ethnicity, socio-economic status (SES), marital status, maternal education level, prenatal alcohol and cigarette use, and perinatal complications.

Social and emotional development were evaluated using the Roberts Apperception Test for Children (RATC; McArthur & Roberts, 1982). The RATC is a simple and objective measure which assesses respondents' interpretation of everyday events and adaptive and maladaptive functioning through a storytelling format. Interpretation of respondents' stories assumes any thoughts, feelings, and conflicts present reflect internal concerns or worries. Analyses revealed ME children applied themes of anxiety, aggression, rejection, and

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maladaptive outcome to their stories at a significantly higher rate than comparison children. These findings are suggestive of increased fears and concerns in ME children, suggesting children prenatally exposed to methadone are less emotionally adjusted compared to their non-exposed peers.

The second study included in this review is a longitudinal study by Soepatmi (1994; see Table 2.1). A range of neurodevelopmental outcomes were assessed in 91 heroin-exposed or heroin and methadone-exposed children when they were aged between 3.5 and 12 years. Social competence was assessed as a key developmental outcome using the total social competence score derived from the caregiver completed Child Behaviour Checklist (CBCL; Achenbach, 1991). Soepatmi (1994) reported a significantly higher proportion of exposed boys aged four to five years and exposed girls aged six to 11 years scored above the 90th percentile on total social competence, suggesting exposed children were at a significantly greater risk of impaired social competence compared to the non-exposed reference population.

A further study by Walhovd et al. (2007; see Table 2.1) examined the neurological correlates of CBCL scores for 14 adopted opiate-exposed, and 14 non-exposed comparison children as part of a case-control longitudinal study. Caregiver-child dyads were recruited through a pre-existing study focused on the development of children born to illicit drug users. Children were excluded from the study if they were living in foster homes ($n = 29$), living in unknown conditions ($n = 4$), or diagnosed with foetal alcohol syndrome ($n = 3$). At assessment primary caregivers completed the CBCL and the child underwent a structural MRI scan. Significant between-group differences were reported on the CBCL social problems scale ($p = .001$), whereby opiate-exposed children had higher primary caregiver rated social problems compared to non-exposed children.

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Extending Walhovd et al.'s (2007) findings, Nygaard et al. (2016; see Table 2.1) evaluated the social development of 78 opiate-exposed and 58 non-exposed comparison children, aged 8.5 years, in their prospective longitudinal study. Utilising the CBCL, Nygaard et al. (2016) investigated parent and teacher reported social problems. Controlling for age, gender, SES, gestational age at birth, and birth weight, opiate-exposed children obtained significantly higher parent rated ($p = .001$), but not teacher rated ($p = .06$) social problem scores than comparison children. However, teacher rated social problem scores were slightly higher in opiate-exposed ($M = 2.6$) than comparison children ($M = 1.3$).

The reviewed studies report an association between prenatal opiate exposure and later child social and emotional outcomes. Opiate-exposed children are characterised by heightened levels of emotional regulation difficulties, impairment in social functioning, increased peer rejection, and low levels of overall social competence compared to their non-exposed peers (de Cubas & Field, 1993; Nygaard et al., 2016; Soepatmi, 1994; Walhovd et al., 2007). Despite consistent findings, little research exists focusing on the social development of ME school-aged children. The current thesis aims to address this research gap by examining the interpersonal social behaviour of children born to methadone maintained mothers.

2.3.2 Behavioural Adjustment of Children Prenatally Exposed to Opiates. The second part of the review of existing research focuses on the behavioural adjustment of opiate-exposed children. Children characterised by poor behavioural adjustment often exhibit persistent patterns of aggressive, hyperactive, inattentive, noncompliant, impulsive, withdrawn, and somatising behaviours. Both internalising and externalising behavioural difficulties are prominent in opiate-exposed children, with these problems evident from as early as three years of age (Hayford, Epps, & Dahl-Regis, 1988; Sarfi et al., 2013). Less is known about school-aged opiate-exposed children's adaptive and maladaptive behaviour

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Table 2.1.

Summary of Studies Examining Social and Emotional Problems School-aged Children Born to Opiate-dependent Mothers

Author	Study Design	Sample	Age	Retention at Follow-up	Measures	Findings	Limitations
de Cubas and Field (1993), United States of America	Cross-sectional	20 ME (Male: 11) 20 C (Male: 11)	6 - 13 years $M = 8.5$ years $M = 7.8$ years	N/A	RATC (PRF)	ME higher anxiety, aggression, rejection, and maladaptive scores ($p < .05$)	Small sample size, no multi-informant measures, large age range, methadone dose not reported, non-random control group
Nygaard et al. (2016), Norway	Prospective longitudinal	78 OE (6 excluded due to foetal alcohol disorder, revised $n = 72$; Male: 42) 58 C (Male: 35)	8.5 years	92%	PRF and TRF CBCL social problems scale	OE higher CBCL PRF rated social problems ($p = .001$) but not TRF ($p = .06$)	Adjusted P values, confounding variables not controlled for, possible poly drug effects, exclusion of participants, results may not generalise, examiners were not blind to group, no reliable measure of drug use
Soepatmi (1994), Netherlands	Longitudinal	HE and H/ME: 91 C: $n =$ unknown	3.5 - 12 years	63%	CBCL (PRF); TSCS	Higher proportion of exposed boys aged 4 - 5 years ($p = .001$) and girls 6 - 11 ($p = .009$) in 90 th percentile for TSCS	Lack of appropriate control group, no reliable measure of drug use, exposure levels not reported, confounding variables not considered, no multi-informant measures
Walhovd et al. (2007), Norway	Prospective longitudinal	14 OE 14 C	9 - 11 years	20% (due to drop out and exclusions)	CBCL (PRF)	OE had higher CBCL social problem scores ($p = .001$)	Small sample size, no reliable measure of drug use or exposure, high sample attrition, no multi-informant measures

Note. ME = methadone-exposed; C = control; OE = opiate-exposed; HE = heroin-exposed; H/ME = heroin and/or methadone-exposed; CBCL = Child Behaviour Checklist; TSCS = Total Social Competence Score; TBPS = Total Behaviour Problem Score; RATC = Roberts Apperception Test for Children; PRF = parental report form; TRF = teacher report form.

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patterns. Four previously reviewed studies also included behavioural outcome measures (de Cubas & Field, 1993; Nygaard et al., 2016; Soepatmi, 1994; Walhovd et al., 2007; see Table 2.2). Using the Child Behaviour Checklist (CBCL), these four studies reported significant differences in prenatally exposed and non-exposed children's behavioural patterns. de Cubas and Field (1993) and Nygaard et al. (2016) reported significant differences on both externalising and internalising subscales, whereby opiate-exposed children displayed heightened levels of hyperactive, aggressive, and depressive symptoms than non-exposed comparison children. In contrast Walhovd et al. (2007) report no significant differences in externalising behaviour patterns within their population of 14 opiate-exposed children. Significant differences were also noted by Nygaard et al. (2016) and Walhovd et al. (2007) in exposed children's attentional abilities, whereby increased attentional difficulties were evident in opiate-exposed samples. Both Soepatmi (1994) and Walhovd et al. (2007) reported significant differences in overall total problem behaviours in their opiate-exposed groups compared with non-exposed groups. Together these findings are suggestive of behavioural maladjustment in opiate-exposed children.

Additional support for poor behavioural adaptation in opiate-exposed school-aged children is provided by Ornoy, Segal, Bar-Hamburger, and Greenbaum (2001; see Table 2.2) and Bada et al. (2012; see Table 2.2). In their cross-sectional study Ornoy et al. (2001) used a range of measures to evaluate the effects the postnatal environment may have on children's behavioural adjustment. Children were separated into groups based on prenatal drug exposure, postnatal drug exposure, and living circumstances. Two groups consisted of children prenatally exposed to heroin either raised at home ($n = 31$) or adopted ($n = 34$), one group consisted of postnatal drug exposure through paternal drug use ($n = 33$), and two groups consisted of non-exposed comparison children raised in low SES ($n = 32$) or average SES ($n = 30$) conditions.

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Utilising the Conners Questionnaire (Conners, 1969), which measures behaviours typically associated with Attention Deficit Hyperactivity Disorder, significantly higher scores were obtained by children with prenatal opiate exposure, postnatal opiate exposure, and those living in deprived conditions. No significant differences were identified on the Pollack Taper test (Pollack & Tuchner, 1982) which measures inattention and hyperactivity during auditory and visual repetition tasks. However, both heroin-exposed children raised at home and children with postnatal exposure scored lower compared with the other study groups, suggesting environmental circumstances played a role in the heightened presentation of inattentive and hyperactive symptoms within these two groups.

Scores obtained on the CBCL indicate higher levels of both externalising and internalising behaviours in prenatally exposed children living at home, born to drug using fathers, and those raised in low SES conditions compared to children raised in average SES conditions. Taken together these results show the importance of considering contextual factors such as the home environment, when interpreting the development of children prenatally exposed to opiates.

Similar results were obtained by Bada et al. (2012) who used data from the Maternal Lifestyle Study, a longitudinal research project that included 1,022 American children aged five to 15 years. Children were matched on gestational age, gender, race, and ethnicity. The majority of children included were identified as having exposure to cocaine in addition to other licit or illicit substances throughout gestation. Participants were separated into four groups according to substance exposure. Group 1 consisted of children prenatally exposed to high levels of cocaine (≥ 3 times per week in the first trimester of gestation) in addition to other drugs (for example nicotine, alcohol, or marijuana; $n = 115$), Group 2 consisted of children with some prenatal cocaine exposure and other drug exposure ($n = 235$), Group 3 consisted of children with no prenatal cocaine exposure but who were exposed to other drugs

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prenatally ($n = 417$), and Group 4 consisted of children who were not exposed to any substances prenatally ($n = 255$).

Bada et al. (2012) used the CBCL to measure parent reported internalising and externalising behaviours, attention, and total behaviour problems. Study findings include significantly higher levels of externalising and attention problems for Groups 1, 2, and 3 when controlling for overall cumulative risk and protective factors. Additionally, Groups 1 and 3 attained higher total problem behaviour scores when controlling for cumulative risk and protective factors. No statistically significant group differences were identified in internalising behaviour problems. These findings not only suggest abnormal behavioural development occurs in children prenatally exposed to cocaine, but also occurs in children exposed to other licit and illicit substances such as nicotine and marijuana.

2.4 Summary of Existing Research

Whilst limited, existing research examining the social, emotional, and behavioural outcomes of children prenatally exposed to opiates highlights several important points. First, there is clear evidence to suggest prenatal exposure to opiates is associated with social competence difficulties in school aged children. More specifically, exposed children have been found to exhibit elevated levels of inattention, aggression, and internalising and externalising behaviours. Additionally, these children are socially withdrawn, experience more peer related problems, and have poorer emotion control. Although only one study in this review examined children prenatally exposed to methadone, reported findings were consistent with studies examining children prenatally exposed to other opiates such as heroin. While the previously reviewed research provides support for adverse outcomes resulting from prenatal exposure to opiates, these studies were characterised by numerous methodological shortcomings. These limitations will now be discussed.

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Table 2.2.

Summary of Studies Examining Behaviour Problems School-aged Children Born to Opiate-dependent Mothers

Author	Study Design	Sample	Age	Retention at Follow-up	Measures	Findings	Limitations
Bada et al. (2012), United States of America	Longitudinal cohort from birth	1022 OE	5, 7, 9, 11, 13, and 15 years	73.6%	CBCL (PRF)	G1: significant externalising ($p < .001$), attention ($p < .05$), and total ($p < .01$) scores controlling for risk and protective indices,	Group classification does not allow for analysis of specific drug effects, unknown if PCE affects protective factor, no multi-informant measures, results may not generalise
		G2: Some PCE/OD: 235 (Male: 123)				G2: significant externalising ($p < .05$) and attention problem ($p < .001$) scores controlling for risk and protective indices,	
		G3: PCE-/OD+: 417 (Male: 220)				G3: significant externalising, total ($ps < .01$), and attention ($p < .05$) scores controlling for risk and protective indices,	
		G4: PCE-/OD-:255 (Male: 139)				High levels of protective factors led to declining trajectories of problem behaviours for all groups	
de Cubas and Field (1993), United States of America	Cross-sectional	20 ME (Male: 11) 20 C (Male: 11)	6 - 13 years $M = 8.5$ years $M = 7.8$ years	N/A	CBCL (PRF)	Higher CBCL externalising, internalising, delinquent, depressed, hyperactive (p 's $< .001$), social withdrawal ($p < .05$), aggressive and somatic complaints (p 's $< .01$) for ME	Small sample size, no multi-informant measures, large age range, control group not randomly selected

Note. OE = opiate-exposed; PCE = prenatal cocaine exposure; OD = Other drug; ME = methadone-exposed; C = control; PRF = parent report form; CBCL = Child Behaviour Checklist.

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Table 2.2 continued.

Summary of Studies Examining Behaviour Problems School-aged Children Born to Opiate-dependent Mothers

Author	Study Design	Sample	Age	Retention at Follow-up	Measures	Findings	Limitations
Nygaard et al. (2016), Norway	Prospective longitudinal	78 OE (6 excluded due to foetal alcohol disorder, revised $N=72$; Male: 42) 58 C (Male: 35)	8.5 years	92%	PRF and TRF CBCL	OE higher CBCL TRF and PRF rated internalising ($p = .004$), externalising (PRF: $p = .001$, TRF: $p = .01$), and attention problems (PRF: $p < .001$, TRF: $p = .003$)	Adjusted P values, confounding variables not controlled for, possible poly drug effects, exclusion of participants, results may not generalise, examiners were not blind to group
Ornøy et al. (2001), Israel.	Cross-sectional	Total: 160 G1: 31 HE living at home (Males: 18) G2: 34 HE adopted (Males: 19) G3: 33 DDF (Males:20) G4:32 Low SES (Males: 12) G5: 30 C – average SES (Males: 15)	5 - 12 years $M = 8.01$ $M = 7.39$ $M = 7.85$ $M = 8.47$ $M = 8.18$	N/A	The Conners Questionnaire The Pollack Taper Test CBCL	G1, G3, and G4 had higher CBCL externalising ($p < .01$), internalising ($p < .01$) scores compared to G5 G2 higher CBCL externalising scores compared to G5 ($p < .01$) G1, G2, G3, and G4 higher Conners score than G5 ($p < .01$) No significant differences on Pollack Taper Test	Poly drug effects not controlled for, reliance on maternal self-report of drug use, methadone dose not reported, unequal prenatal care, no multi-informant measures

Note. OE = opiate-exposed; C = control; HE = heroin-exposed; DDF = drug dependent father; SES = socio-economic status; PRF = parent report form; TRF = teacher report form; CBCL = Child Behaviour Checklist.

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Table 2.2 continued.

Summary of Studies Examining Behaviour Problems School-aged Children Born to Opiate-dependent Mothers

Author	Study Design	Sample	Age	Retention at Follow-up	Measures	Findings	Limitations
Soepatmi (1994), Netherlands	Longitudinal	HE and H/ME: 91 C: <i>n</i> = unknown	3.5 - 12 years	63%	CBCL (PRF); TBPS	Higher proportion of exposed boys aged 4 - 5 years ($p = .000001$) and girls 6 - 11 ($p = .012$) in 90 th percentile for TBPS	Lack of appropriate control group, no reliable measure of drug use, exposure levels not reported, confounding variables not considered, no multi-informant measures
Walhovd et al. (2007), Norwat	Longitudinal	14 OE 14 C	9 - 11 years	20% (due to drop out and exclusions)	CBCL (PRF)	OE had higher CBCL total problems ($p = .023$) and attention problems ($p = .003$), but not externalising ($p = .12$)	Small sample size, no reliable measure of drug use or exposure, high sample attrition, no multi-informant measures

Note. HE = heroin-exposed; H/ME = heroin and methadone-exposed; C = control; OE = opiate-exposed; CBCL = Child Behaviour Checklist; TBPS = Total Behaviour Problem Score; PRF = parent report form.

2.5 Methodological Limitations of School Age Child Outcome Studies

Several methodological limitations highlighted in the preceding review limit the interpretation of existing studies. First, many studies included a small sample size (de Cubas & Field, 1993; Ornoy et al., 2001; Walhovd et al., 2007). Sample size is an important factor that may contribute to diverse findings within the opiate-exposed literature. This limitation is demonstrated in Nygaard et al. (2016) and Walhovd et al. (2007) studies whose samples originated from the same participant pool. In the small selective sample consisting of 14 opiate-exposed and 14 non-exposed comparison children (Walhovd et al., 2007) no group differences were noted for the externalising subscale on the Child Behaviour Checklist (CBCL), however significant differences were identified when using the full population pool (Nygaard et al., 2016). Significant group differences were also reported in other studies with large sample sizes (Bada et al., 2012; Ornoy et al., 2001). The use of a small sample can decrease the reliability and validity of results obtained, and simultaneously compromise the generalisability of results to the larger opiate-exposed population.

A second limitation concerns the high rates of sample attrition. For example, Soepatmi's (1994) original sample totalling 168 dropped to 144 participants meeting the re-recruitment criteria for their follow-up. Of the 144 participants available for re-recruitment, 91 participated in the follow-up, resulting in a 37 percent attrition rate. A further study with a high level of sample attrition was Walhovd et al. (2007) with only 20 percent retention in their follow-up. The authors noted reasons for exclusion included: participants living in foster homes or at unknown addresses, diagnosis of foetal alcohol syndrome, and participants being under the age of nine at assessment. These exclusions resulted in a drop from 136 to 28 participants. High attrition rates may create difficulties in interpretation of results due to the possibility individuals who refused or are excluded may be representative of high risk and/or low-SES families characterised by heightened levels of socio-familial adversity. Neglecting

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inclusion of these families may also increase the risk of Type-II errors which occur when statistical power is low. This can be seen in the absence of significant differences between opiate-exposed and non-exposed children in externalising behaviours in a characteristically small sample with a low retention rate (Walhovd et al., 2007), compared with significant externalising behaviour differences between opiate-exposed and non-exposed children in a larger sample with a high retention rate (Bada et al., 2012; Nygaard et al., 2016).

A lack of independent confirmation of maternal drug use is a further limitation in many of the studies reviewed (Bada et al., 2012; Nygaard et al., 2016; Ornoy et al., 2001; Soepatmi, 1994; Walhovd et al., 2007). Reliance on self-report of maternal drug consumption can result in inaccurate reporting of the extent of poly-substance exposure experienced by the foetus. Inaccurate reporting may result from denial, underestimation of total substance use, or a fear of being judged. Poly-substance use in addition to alcohol and nicotine use limits the interpretation of results produced by the study. For example, Nygaard et al. (2016) cannot draw conclusions on causal links between drug exposure and risk factors inherent in their high-risk sample, due to the absence of independent assessment of maternal substance use.

A final limitation worthy to note is the lack of multiple informant measures, such as inclusion of both parent and teacher report, or parent report and observational research. Only one study included in this review included both parent and teacher report (Nygaard et al., 2016). Excluding multiple informant measures can result in a bias of results and incorrect conclusions, affecting reliability and validity of obtained data. Additionally, the extent of situational and pervasive problem behaviours cannot be identified. For example, de Cubas and Field (1993) cannot generalise their findings of differences in methadone-exposed and non-exposed children's behaviour problems across multiple environments, due to their reliance on parental report measures.

2.6 Socio-Familial and Environmental Factors Associated with Social Competence

In addition to the direct biological effects prenatal exposure to teratogenic substances may have on a developing child, drug exposed children are also at increased risk of numerous adverse postnatal and early childhood environmental experiences. These experiences can negatively affect children's subsequent developmental outcomes. For example, deficits in cognitive functioning and behavioural adjustment are evident in children exposed to socio-economic adversity (Lester & Lagasse, 2010; Vucinovic et al., 2008). Drug-using women are at increased likelihood of maintaining a high-risk lifestyle characterised by poor nutrition, exposure to violence, financial and housing troubles, lower educational achievement, single parenthood, unemployment, and concurrent licit and illicit drug use (Bada et al., 2012; Davie-Gray et al., 2013; Johnson et al., 2003; Suchman & Luthar, 2001; Vucinovic et al., 2008). Such adverse conditions have been suggested as contributing factors for heightened levels of familial stress (Anthony et al., 2005), exposure to suboptimal parenting (Suchman & Luthar, 2001), and parent mental health issues such as maternal anxiety and depression (Davie-Gray et al., 2013; Sarfi et al., 2013), all which can negatively impact on a child's development (Accornero, Morrow, Bandstra, Johnson, & Anthony, 2002; Bada et al., 2012; Choe, Olson, & Sameroff, 2013; Cole, Teti, & Zahn-Waxler, 2003; Rispoli et al., 2013; Sarfi et al., 2013).

Low socio-economic status (SES) is known to be negatively associated with a child's developmental outcome. Children raised in poverty or who experience significant social adversity are at increased risk of suboptimal development compared with children raised in wealthy non-risk environments (Ornoy, Michailevskaya, Lukashov, Bar-Hamburger, & Harel, 1996; Ornoy et al., 2001). Consistent experience of social adversity is associated with increased socio-emotional difficulties, including depression, internalising and externalising behaviours, and poor social competence (Eamon, 2001). While significant associations are evident between regular licit and illicit drug use and adverse environmental circumstances, a

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lack of research exists examining the dual impact of prenatal exposure to methadone and living in adverse environmental circumstances on the development of exposed children.

One study has examined differences seen in opiate-exposed children raised at home and those who were adopted by non-opiate-using families shortly after birth (Ornoy et al., 1996; Ornoy et al., 2001). Observed differences suggest children raised by non-opiate-using families fare better in their cognitive, motor, and behavioural development, with exposed children who were adopted into non-opiate-using families functioning at a level similar to comparison children born to non-opiate-using families. These findings shows that it is vital to consider not only the direct biological effects of prenatal drug exposure but to also the environmental conditions the child is exposed to.

Early parent-child interactions and environmental experiences have been identified as crucial in the facilitation of children's social development (Rispoli et al., 2013). Parental characteristics such as warmth, acceptance, and emotional support have been shown to shape and foster development of a child's social competence (Maccoby & Martin, 1983; Rispoli et al., 2013). Whereas parental negativity, high or low levels of control, lack of support, rejection, and insensitivity are potentially detrimental to a child's social development (Kopala-Sibley, Zuroff, & Koestner, 2012; Maccoby & Martin, 1983; Rispoli et al., 2013). For example, a study by Anthony et al. (2005) examined 307 children aged 26 to 59 months using the Parenting Behaviour Checklist (Fox, 1994), Parenting Stress Index-Short Form (Abidin, 1990), and Social Competence and Behaviour Evaluation (LaFreniere & Dumas, 1995). Higher discipline scores were found to be associated with lower ratings of child social competence, whereas higher levels of nurturing behaviour were related to higher ratings of social competence. Further support for poor parent-child interactions affecting behaviour development was provided by Cole, Teti, and Zahn-Waxler (2003), who reported increased

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levels of externalising behaviour problems in preschool-aged children with mothers who reacted to their child's distress with anger.

It is important to consider parenting behaviour as a potential influence on social competence in children prenatally exposed to methadone as research often reports less than optimal parent-child interactions within this population compared with normative families (Suchman & Luthar, 2001). More specifically, mothers maintained on methadone are more likely to describe themselves as being less involved and less interested in their children, compared with a normative comparison group (Suchman & Luthar, 2001). Observations of parental practices in this population include poor parent-child attachment, involvement and responsiveness, harsh interactions, and inconsistent disciplinary practices (Kelley, 1992; Suchman & Luthar, 2001). These deficiencies can reflect environmental and psychosocial risk factors inherent to maternal addiction, such as increased stressors and socio-demographic risk (Suchman & Luthar, 2000, 2001).

Extreme levels of maternal and caregiver distress have been found to be disruptive of parent-child interactions which can contribute to maladaptive outcomes for the child (Choe et al., 2013). Maternal depression is associated with increased externalising behaviours in children and adolescents. For example, Campbell et al. (2004) examined maternal depressive symptoms and children's subsequent attachment at 36 months, reporting that the presence of maternal depressive symptoms was predictive of higher rates of insecure attachment. Furthermore, increased negative, intrusive, and hostile behaviours toward their children's attempts at social interactions and independence are present in mothers in a heightened state of distress (Choe et al., 2013). In their longitudinal study Choe, Olson, and Sameroff (2013) report high levels of maternal distress corresponded to less inductive discipline and maternal warmth which in turn led to less effortful control in children at age three. These findings

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suggest that high levels of maternal distress increase children's risk of externalising problems through poor parenting.

Due to the experience of prenatal drug exposure and the heightened risk of experiencing a suboptimal postnatal environment, children prenatally exposed to methadone are often identified as a 'dual hazard' population. Figure 2.3 depicts the dynamic and complex interrelationship between prenatal drug exposure and postnatal environment influences on a developing child (Lester & Tronick, 1994). This conceptual model when applied to the methadone-exposed population allows for the examination of the individual effects prenatal drug exposure has on child development, while considering the influence of social and family factors present in the postnatal environment. Lester and Tronick's (1994) model posits an initial effect of prenatal drug exposure on neurobehavior during the neonatal period, with this neurological vulnerability either exacerbated or buffered by socio-familial and environmental conditions present in the postnatal environment. Being raised in a positive and risk free environment is theorised to alleviate the effects of prenatal drug exposure, thus allowing a child prenatally exposed to methadone to develop to its fullest potential.

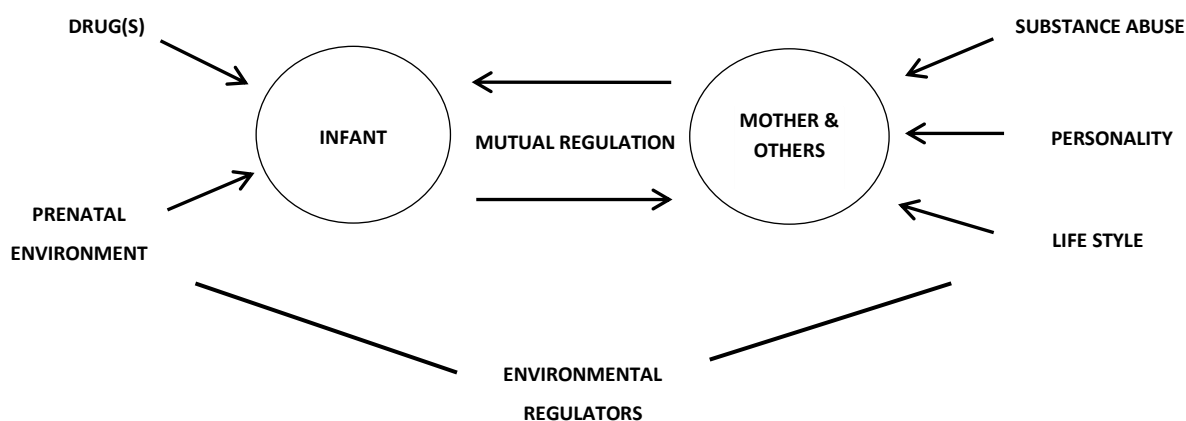


Figure 2.3. Systems Model of Prenatal Drug Exposure (Lester and Tronick, 1994)

CHAPTER 3

Aims and Hypotheses

The preceding review of existing research highlights the impact prenatal exposure to opiates has on school-aged children's social, emotional and behavioural adjustment. To date, research focusing on such outcomes in school-aged methadone-exposed individuals is limited, despite evidence suggesting early developmental and behavioural difficulties caused by opiate exposure in methadone-exposed children. The current study aims to examine two domains of social competence in children prenatally exposed to methadone at age 9.5 years to address this research gap. Specific research aims and hypotheses are as follows:

1. To describe the social competence of children born to opiate dependent mothers enrolled in methadone maintenance treatment during pregnancy and a comparison group of typically developing children born to non-using mothers, at age 9.5 years. Specific social competence domains examined include, emotional and behavioural adjustment and interpersonal social behaviour.
2. To compare the social competencies between children prenatally exposed to methadone with a comparison group of typically developing non-exposed children, at age 9.5 years.

Hypothesis 1: At age 9.5 years, children prenatally exposed to methadone will have poorer outcomes in domains of social competence compared with the comparison group of typically developing children.

3. Identify neonatal, child, and socio-familial predictors of social competence, at age 9.5 years.

Hypothesis 2: Methadone exposure will predict poorer social competence outcome at age 9.5 years over and above the effects of neonatal, child, and socio-familial risk factors.

CHAPTER 4

Method

4.1 Research Design

The current research draws on data from a prospective longitudinal study investigating the effects prenatal exposure to methadone has on children's later neurodevelopmental outcomes, conducted by the Canterbury Child Development Research Group. Two groups of participants were recruited for the study: one group included pregnant mothers maintained on methadone and a second group comprised of non-opiate-dependent pregnant mothers. Children included in the current study have been assessed at term, 18 months, two years, and 4.5 years (retention: 91%). The current thesis draws on data collected from the 9.5 year phase.

The author was involved in the administration of four behavioural regulation tasks and the language and communication task during child assessments from January 2017. The author also scored the behavioural regulation tasks, and completed direct data entry and scoring for several other measures. The sample for the current study consisted of 75 methadone-exposed children, and 96 non-exposed comparison children. Data collection for the remainder of participants in the study is still ongoing.

4.2 Sample

The study sample comprises two groups of children born at Christchurch Women's Hospital between the years 2003 and 2008. Children were excluded from the study if they were born very preterm (< 32 weeks gestation); diagnosed with Foetal Alcohol Syndrome, a congenital abnormality, or HIV; or born to families who did not speak English, or families who were deemed unable to give informed consent due to cognitive or mental health concerns.

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4.2.1 Methadone-Exposed group. The first group of participants were children born to pregnant mothers enrolled in the Christchurch Methadone Maintenance Programme, who were recruited during their second or third trimesters of pregnancy. One hundred and twenty one mother-infant dyads met criteria for inclusion within the study, and of these, 100 (83%) were successfully recruited. Reasons for non-recruitment included refusals ($n = 19$) and missed recruitment ($n = 2$). Information on mothers' daily methadone dosage throughout pregnancy was obtained through both hospital and drug service records.

Social competence data analysed in the current thesis include data collected from June 2013 up to the month of December 2017 from 75 methadone-exposed children. The methadone-exposed children had a mean age at assessment of 9.63 (range: 8.75 – 11.08), and 58.7% of the group were male. Of the 80 methadone-exposed children eligible to participate in the current study, 75 children and their primary caregivers agreed to participate in the 9.5 year follow-up, a retention rate of 94% from the four year phase.

4.2.2 Comparison group. The second group of participants included non-exposed children and their mothers. These mother-infants dyads were randomly selected from the delivery booking schedule of Christchurch Women's Hospital between 2003 and 2008. A total of 173 mother-infant dyads were eligible for inclusion using the same exclusion criteria as for the methadone group. Of the dyads identified, 110 (65%) were successfully recruited during their third trimester or birth; 41 refused participation and 20 could not be traced. Upon inclusion socio-economic profiles were conducted based on regional census data to ensure included families were representative of the general Canterbury region. The comparison sample included in the current thesis includes 92 children and their primary caregiver. Comparison children had a mean age at assessment of 9.48 (range: 9 – 10.92), and 45.8% of the group were male. Of the 101 comparison children eligible to participate in the current

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study, 96 children and their primary caregivers agreed to participate in the 9.5 year follow-up, a retention rate of 95% from the four year phase.

Table 4.1 shows infant clinical and socio-familial characteristics of the methadone-exposed (ME) and non-exposed comparison (non-ME) study participants at term age. One comparison group infant did not have recorded head circumference data, and three comparison infants and one methadone-exposed infant did not have birth length data. The remaining 166 children in the sample had complete data. Both ME and non-ME were born on average around 39 weeks gestation (range 33-43 weeks), but ME infants were at a greater risk than non-ME infants of suboptimal physical development. Specifically, ME infants were on average lighter, shorter, and had a smaller head circumference than non-ME infants (p 's < .001).

At the time of birth, a significantly higher proportion of mothers maintained on methadone had left formal schooling without a qualification, were a single parent, and were from a low-SES family (p 's < .001). There were no differences in the average age of mothers at the time of their child's birth ($p = .710$). Methadone maintained mothers identified as New Zealand Maori (26.7%) and New Zealand European (73.3%). The comparison mothers were 10.4% New Zealand Maori and 81.3% New Zealand European. Additionally, some comparison group mothers identified as ethnic groups not present in the methadone group, with 1.0% selecting Pacific Islander and 7.3% selecting Asian or African. Overall the distribution of ethnicities for the methadone maintained mothers and comparison mothers was not the same ($p = .005$). Methadone-exposed infants were exposed to 2.57 socio-familial risk factors on average, a higher rate than the comparison infants who were exposed to an average of .75 risk factors ($p < .001$).

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Table 4.1

Characteristics of Methadone-Exposed and Non-Exposed Comparison Mothers and Infants at Term

Variable	Methadone Group (<i>n</i> = 75)	Comparison Group (<i>n</i> = 96)	χ^2/t	<i>p</i>
Infant Clinical Data				
% (<i>n</i>) male gender	58.7 (44)	45.8 (44)	2.78	.096
<i>M</i> (<i>SD</i>) gestational age, weeks	38.84 (1.74)	39.23 (1.75)	-1.43	.156
<i>M</i> (<i>SD</i>) birth weight, grams	3060.11 (451.38)	3411.60 (586.77)	-4.43	< .001
<i>M</i> (<i>SD</i>) birth length, cm	50.30 (3.02)	52.17 (3.06)	-3.94	< .001
<i>M</i> (<i>SD</i>) birth head circumference, cm	33.81 (1.49)	34.70 (1.44)	-3.93	< .001
% (<i>n</i>) NAS treatment	86.7 (65)	-		
Maternal Socio-familial Data				
% (<i>n</i>) young mother (< 21 years)	4.0 (3)	5.2 (5)	.138	.710
% (<i>n</i>) left school without qualifications	82.7 (62)	17.7 (17)	71.48	< .001
% (<i>n</i>) single parent	52.0 (39)	10.4 (10)	35.61	< .001
% (<i>n</i>) low SES	92.0 (69)	24.0 (23)	78.43	< .001
<i>M</i> (<i>SD</i>) Cumulative Socio-Familial Risk ^a	2.57 (0.95)	.76 (1.24)	10.51	< .001
Primary Caregiver Changes				
<i>M</i> (<i>SD</i>) Changes				
Maternal psychological well-being	1.44 (1.69)	.00 (.00)	7.39	< .001
<i>M</i> (<i>SD</i>) EPDS score ^a	11.92 (6.50)	5.07 (4.74)	7.63	< .001
Maternal Ethnicity				
% (<i>n</i>) NZ Māori	26.7 (20)	10.4 (10)		
% (<i>n</i>) NZ or Other European	73.3 (55)	81.3 (78)		
% (<i>n</i>) Pacific Islander	0 (0)	1.0 (1)		
% (<i>n</i>) Asian or African	0 (0)	7.3 (7)	12.93	.005
% Minority	26.7 (20)	17.7 (17)	1.99	.158

Note. ^a higher scores = negative; missing term data = birth head circumference missing for one comparison infant, birth length missing for three comparison infants and one ME infant; NAS = neonatal abstinence syndrome; EPDS = Edinburgh Postnatal Depression Scale.

Table 4.2 presents maternal reported drug use at term. Methadone maintained mothers reported higher rates of licit and illicit substance use throughout pregnancy ($p < .001$) and 92% reported smoking cigarettes during pregnancy compared to 14.6% of the comparison

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group mothers ($p < .001$). No differences in alcoholic beverage consumption were identified ($p = .881$).

Table 4.2

Maternal Licit and Illicit Drug Use During Pregnancy for Methadone Maintained, and Comparison Mothers at Term

Variable	Methadone Group ($n = 75$)	Comparison Group ($n = 96$)	χ^2/t	p
$M (SD)$ cigarettes smoked per day	12.88 (8.74)	1.34 (3.90)	10.65	$< .001$
% (n) any cigarette use	92.0 (69)	14.6 (14)	101.03	$< .001$
% (n) any alcohol use	17.3 (13)	18.8 (18)	.057	.811
% (n) any cannabis use	48.0 (36)	1.0 (1)	54.76	$< .001$
% (n) any opioid use	26.7 (20)	-	28.99	$< .001$
% (n) any benzodiazepine use	38.7 (29)	-	44.70	$< .001$
% (n) any stimulant use	20.0 (15)	-	21.05	$< .001$

4.3 Assessment Procedure

At the age of 9.5 years (range 8.75 to 11.08 years) children participated in a comprehensive neurodevelopmental assessment. Assessments were predominately carried out at the Children Development Research house located on the University of Canterbury campus, with home and school visits organised if it was more convenient for the family. Child assessments were conducted by trained research staff and clinical psychologists who were blind to the child's group status. Upon arrival at the assessment, each study child's primary caregiver was briefed on the developmental assessment including details of the purpose of the study. It was reiterated before beginning the assessment that participation is voluntary and they can discontinue the study at any point without any negative repercussions, and information obtained is entirely confidential. The primary caregiver then signed consent forms for their child/children to participate in this follow-up study (see Appendix A).

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During an assessment, the child completed a battery of tests aimed at assessing their overall neurodevelopment. At the same time, in an adjoining room, the primary caregiver and a trained interviewer completed a questionnaire booklet which included standardised scales. Caregivers were provided a gratuity voucher of their choice as thanks for participation in the study. Following the conclusion of the assessment, with signed consent, the child's current teacher was contacted and sent an interview booklet to complete.

4.4 Study Measures

4.4.1 Social competence at age 9.5 years. The present study utilised the Behavior Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004) to measure child social competence at age 9.5 years. The BASC-2 is a comprehensive multi-dimensional questionnaire designed to assess adaptive behaviours, problem behaviours, and symptoms of psychopathy. It is suitable for children and young adults aged two to 25 years, across multiple settings. The current study employed the Parent Rating Scale (PRS-C; 160 item) designed for use on children aged between six and 11 years. Primary caregivers completed the BASC-2 based on their experiences with the target child. All responses were recorded on a four-point Likert scale where N = never, S = sometimes, O = often, and A = always. The PRS-C consists of four composites; 14 primary scales, which measure adaptive and problem behaviour; and seven content scales, which provide supplementary information for the interpretation of the primary scales. Each item on a scale describes a behaviour which may or may not relate to the child, for example, 'has difficulty explaining the rules of games to others'. The BASC-2 is a well-validated questionnaire with reliability and validity confirmed using a large sample of American children representative of the wider population of the United States between the years 2002 and 2004 for sex, SES, race, ethnicity, geographic location, and special-needs or gifted programmes (Reynolds & Kamphaus, 2004).

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Two composites: externalising behaviour and internalising behaviour; and four individual subscales of the BASC-2: emotional self-control, social skills, withdrawal and functional communication, were included in this study. Composite scores were calculated by the BASC-2 ASSIST scoring programme.

Externalising composite scores used the hyperactivity, aggression, and conduct problems scales of the BASC-2. This composite examines disruptive or ‘under-controlled’ behaviour problems such as hyperactivity, aggression, and delinquency. A high score on this composite indicates the presence of externalising behaviours.

Internalising composite scores were formed using the anxiety, depression, and somatization scales of the BASC-2. This composite examines the behaviours which can be considered ‘over-controlled’. A high score on this composite indicates the presence of internalising behaviours.

The BASC-2 emotional self-control content scale consists of six items assessing a child’s ability to regulate their affect and emotions in response to environmental changes. Questions on this scale gauge the extent a child is experiencing or being influenced by emotional symptoms. Sample items include ‘seems to take setbacks in stride’ and ‘is easily upset’. A high score indicates poor emotional self-control.

The BASC-2 social skills adaptive scale is based on eight items which assess a child’s level of interpersonal skills held required for effective social interaction. Items on this scale gauge the extent to which an individual, in this case a child, possesses behaviours of encouragement and assistance, and are complimentary and well mannered. Sample items on the parent rating questionnaire include ‘congratulates others when good things happen’ and ‘shows interest in others ideas’. A low score on this scale indicates poor social skills.

The BASC-2 withdrawal clinical scale includes 12 items which assess a child’s social performance, whether they openly interact with others, or whether they shy away from social

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situations and prefer to remain unnoticed. Questions on this scale gauge a child's tendency to avoid or lack interest in social contact within social settings. Sample items from the parent questionnaire include 'makes friends easily', 'acts as if other children are not there', and 'is shy with adults'. A high score on this scale indicates high levels of withdrawal.

The BASC-2 functional communication adaptive scale assesses a child's ability to express and communicate ideas in ways other can easily understand. This scale includes 12 items. Sample items from the parent questionnaire include 'is unclear when presenting ideas', 'has difficulty explaining the rules of games to others', and 'communicates clearly'. A low score indicates poor functional communication.

4.4.2 Covariate measures.

4.4.2.1 Socio-familial risk. To provide an overall measure of socio-familial risk at term, a composite measure was formulated consisting of five dichotomous variables. Measures were obtained at term age through hospital data bases and parent interviews. For each socio-familial risk indicator (measure), a score of 0 or 1 was assigned, where 1 = risk exposure and 0 = no risk exposure. Scores were then summed to create a cumulative socio-familial risk score. Variables included in the socio-familial risk index include:

1. Minority Ethnicity: Based on maternal report at term, child's ethnicity was recorded at 0 = NZ European/Other European or 1 = Ethnic Minority (NZ Maori, Pacific Islander, Asian, African, or Other).
2. Young mother: A binary measure for if the mother was under 21 years at the time of childbirth.
3. Low maternal education: Based on maternal report at term. A binary measure for if the mother has no high school or tertiary qualifications.
4. Low socio-economic status (SES): Based on maternal report at term. SES was assessed using the Elley-Irving Socio-Economic Index (Elley & Irving, 2003). In this index

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families are ranked in SES by occupation, from '1' being the highest level (professional) to '6' the lowest level (unemployed). The present study classified families as having low-SES if caregivers were unemployed, or working unskilled, semi-skilled, and skilled jobs. Families were characterised as high-SES if the caregivers were working in professional, managerial, or technical jobs.

5. Single parent family at birth: Based on maternal report at term. A binary measure for if the primary caregiver was a single parent at birth.

4.4.2.2 Clinical measures. The following measures of infant clinical status were identified as potential predictors and selected from the larger study database. These measures were obtained from hospital records and clinical evaluations.

1. Methadone exposure: Methadone was recorded at 1 = Exposed, or 2 = Non-exposed.
2. Gender: Gender was recorded as 1 = Male, or 2 = Female.
3. Birth weight: Recorded at time of birth (grams).
4. Head circumference: Recorded at time of birth (centimetres).
5. Other drug exposure: Other drug exposure consisted of maternal drug consumption of cigarettes, alcohol, cannabis, opiates, benzodiazepines, and/or stimulants throughout gestation. Other drug exposure consisted of six outcome variables and was recorded as 1 = Exposed, or 2 = Non-exposed.

4.4.2.3 Primary caregiver changes. Children's primary caregivers reported who the child's maternal and paternal figures were for each six month period preceding the child's developmental assessments at 18 months, 2 years, 4.5 years, and 9 years. The present study classed the child's primary caregiver as the person who was currently looking after the child for the majority of the time. Children's total number of primary caregiver changes was calculated through the summation of the total number of primary caregivers from birth to age 9 years.

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4.4.2.4 Maternal depression. Maternal depression was assessed at term using the Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987). The EPDS consists of a series of 10 questions which the respondent answers based on how they have felt over the previous two weeks. Responses are recorded on a 4-point scale, where: 0 = often, 1 = sometimes, 2 = hardly ever, and 3 = never.

4.5 Statistical Analyses

Data analyses were performed using the Statistical Package for Social Sciences (SPSS) version 25. Parametric and non-parametric statistics were used as required. Statistical significance was set at $p < .05$. Analyses were conducted in three steps. First, group comparisons on measures of behavioural adjustment and interpersonal social behaviour were examined using the t -test for independent samples. Effect size estimates were examined using Cohens d , which indicate the standardised difference between two group means.

Second, Confirmatory Factor Analysis (CFA) was conducted to validate a theoretically constructed model of interpersonal social behaviour. Multiple fit indices were used to assess model fit. Fit indices included: the chi-square statistic (χ^2), the root mean square error of approximation (RMSEA), and the comparative fit index (CFI). Cut-off criteria indicating an acceptable fit were as follows $\chi^2 = \text{n.s.}$, RMSEA $< .08$, and CFI $> .90$ (Kline, 2011) and the following criteria indicating a good fit RMSEA $< .06$, CFI $> .95$ (Hu & Bentler, 1999).

Third, correlational, univariate, and multiple regression analyses were carried out to identify and examine infant clinical and socio-familial characteristics associated with poor social competence in methadone-exposed and non-exposed comparison children at age 9.5 years.

4.6 Ethical Approval

Ethical consent for the 9.5 year follow-up study was obtained from the Southern Health and Disability Ethics Committee (*Reference*: URB/07/10/042, see Appendix B).

CHAPTER 5

Results

Performance of methadone-exposed (ME) and non-exposed (non-ME) children across a range of measures associated with social competence was compared. Results are presented below.

5.1 Externalising Behaviour of Children Prenatally Exposed to Methadone and Non-exposed Comparison Children at Age 9.5 Years

As shown in Table 5.1 ME children had higher mean externalising composite scores than non-ME children, indicating ME children were rated by their caregivers as exhibiting higher levels of under-controlled behaviours, $t(104.38) = 7.02, p < .001$.

ME children were more likely to meet the criteria for ‘at-risk’ and ‘clinically significant’ levels of maladaptive behaviour on the externalising composite. Children are considered to be at risk for maladaptive levels of behaviour if their overall BASC-2 score is between 60 and 69, between one and two standard deviations above the BASC-2 normative data range. An overall BASC-2 score of 70 or more is regarded as clinically significant for maladaptive levels of behaviour (Reynolds & Kamphaus, 2004). Twenty-five percent of ME children, compared to 11.1% of non-ME children received scores in the at-risk range, $\chi^2(1, n = 171) = 14.13, p < .001$. A further 17.4% of ME children met criteria for the clinically significant levels of maladaptive behaviour. In comparison, none of the non-ME children met these criteria, $\chi^2(1, n = 171) = 18.01, p < .001$.

ME children had higher average scores on each individual scale which comprise the overall externalising composite score ($p < .001$). ME children were rated as exhibiting higher levels of hyperactivity ($p < .001$), aggression ($p < .001$) and conduct problems ($p < .001$) than non-ME children. Table 5.1 reports the proportion of ME and non-ME children scoring in the at-risk and clinically significant ranges. A higher proportion of ME children received scores

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which placed them in each of these categories ($p < .001$ and $.002$). Effect size estimates across individual scales and externalising composite scores ranged from $d = -.99$ to -1.16 , indicating large standardised group differences.

Table 5.1

Externalising Behaviour Outcomes of Methadone-Exposed and Non-Exposed Comparison Children at Age 9.5 Years

BASC-2 Scale Scores	Methadone Group ($n = 75$)	Comparison Group ($n = 96$)	χ^2/t	p	d (95% CI)
Composite Score ^a					
M (SD) Externalising Behaviour ^b	58.97 (12.96)	47.44 (6.68)	7.02	$< .001$	-1.16 (-1.49, -0.83)
% (n) at-risk range	25.3 (19)	11.1 (5)	14.13	$< .001$	-
% (n) clinically significant range	17.3 (13)	0 (0)	18.01	$< .001$	-
Individual Scale Scores					
M (SD) Hyperactivity ^b	59.52 (11.69)	48.32 (8.62)	6.95	$< .001$	-1.11 (-1.43, -0.79)
% (n) at-risk range	29.3 (22)	7.3 (7)	14.53	$< .001$	-
% (n) clinically significant range	14.7 (11)	2.1 (2)	9.49	.002	-
M (SD) Aggression ^b	57.64 (12.71)	47.84 (6.59)	6.07	$< .001$	-1.00 (-1.32, -0.68)
% (n) at-risk range	22.7 (17)	6.3 (6)	9.75	.002	-
% (n) clinically significant range	18.7 (14)	1.0 (1)	16.34	$< .001$	-
M (SD) Conduct Problems ^b	57.03 (13.77)	46.97 (6.12)	5.89	$< .001$	-0.99 (-1.31, -0.67)
% (n) at-risk range	21.3 (16)	1.0 (1)	19.36	$< .001$	-
% (n) clinically significant range	16.0 (12)	0 (0)	16.52	$< .001$	-

Note. ^a composite score is calculated using BASC-2 ASSIST software; ^b higher scores are indicative of problem behaviour; at-risk range = T -score of 60 – 69; clinically significant range = T -score of > 70 ; d = Cohen's d effect size; CI = confidence interval.

5.2 Internalising Behaviour of Children Prenatally Exposed to Methadone and Non-exposed Comparison Children at Age 9.5 Years

Table 5.2 shows mean scores obtained by ME and non-ME children on the composite measure of internalising behaviour. ME children obtained significantly higher mean scores than non-ME children, $t(169) = 3.37, p < .001$. A similar proportion of ME (25.3%) and non-ME (15.6%) children received scores in the at-risk range, $\chi^2(1, n = 171) = 2.49, p = .114$. 10.1% of ME children, compared with 1.1% of non-ME children received scores in the clinically significant range, $\chi^2(1, n = 171) = 6.88, p = .009$.

On individual measures, ME children were rated by caregivers as displaying heightened levels of depression ($p < .001$), but not anxiety ($p < .120$) or somatization ($p < .084$) than non-ME children. A higher proportion of ME children than non-ME children were in the at-risk and clinically significant range on the individual scales which come together to form the internalising composite. However only proportions within the depression subscale reached statistical significance ($p_{at-risk} = .003$; and $p_{clinically\ significant} = .019$). Effect size estimates across individual scales and internalising composite scores were small to medium, ranging from $d = -.24$ to $-.78$.

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Table 5.2

Internalising Behaviour Outcomes of Methadone-Exposed and Non-Exposed Comparison Children at Age 9.5 Years

BASC-2 Scale Scores	Methadone Group (<i>n</i> = 75)	Comparison Group (<i>n</i> = 96)	χ^2/t	<i>p</i>	<i>d</i> (95% CI)
Composite Score ^a					
<i>M</i> (<i>SD</i>) Internalising Behaviour ^b	54.61 (12.97)	48.41 (11.13)	3.37	< .001	-0.52 (-0.83, -0.21)
% (<i>n</i>) at-risk range	25.3 (19)	15.6 (15)	2.49	.114	-
% (<i>n</i>) clinically significant range	12.0 (9)	2.1 (2)	6.88	.009	-
Individual Scale Scores					
<i>M</i> (<i>SD</i>) Anxiety ^b	52.24 (11.10)	49.68 (10.25)	1.56	.120	-0.24 (-0.54, 0.06)
% (<i>n</i>) at-risk range	18.7 (14)	11.5 (11)	1.75	.186	-
% (<i>n</i>) clinically significant range	8.0 (6)	4.2 (4)	1.12	.289	-
<i>M</i> (<i>SD</i>) Depression ^b	57.36 (11.86)	49.40 (8.84)	4.86	<.001	-0.78 (-1.09, -0.46)
% (<i>n</i>) at-risk range	26.7 (20)	9.4 (9)	8.94	.003	-
% (<i>n</i>) clinically significant range	16.0 (12)	5.2 (5)	5.48	.019	-
<i>M</i> (<i>SD</i>) Somatization ^b	51.57 (14.24)	48.08 (11.25)	1.74	.084	-0.28 (-0.58, 0.03)
% (<i>n</i>) at-risk range	16.0 (12)	10.4 (10)	1.17	.279	-
% (<i>n</i>) clinically significant range	9.3 (7)	6.3 (6)	.57	.450	-

Note. ^a composite score is calculated using BASC-2 ASSIST software; ^b higher scores are indicative of problem behaviour; at-risk range = *T*-score of 60 – 69; clinically significant range = *T*-score of > 70; *d* = Cohen's *d* effect size; CI = confidence interval.

5.3 Interpersonal Social Behaviour of Children Prenatally Exposed to Methadone and Non-Exposed Comparison Children at Age 9.5 years

Mean scores on measures of social behaviours for ME and non-ME are shown in Table

5.3. ME children were rated by their caregivers as displaying lower levels of social skills ($p < .001$) and functional communication ($p < .001$) and higher levels of withdrawal ($p < .001$) and emotional self-control ($p < .001$) difficulties.

SOCIAL COMPETENCE OF METHADONE-EXPOSED CHILDREN

A higher proportion of ME children scored in the at-risk range for maladaptive behaviours relating to social skills ($p = .003$), withdrawal ($p = .003$), functional communication ($p < .001$), and emotional self-control ($p < .001$; see Table 5.3). The social skills subscale was the only individual subscale where a higher proportion of ME children (4.0%) than non-ME (0%) scored in the clinically significant range $\chi^2(1, n = 171) = 3.91, p < .001$. Effect size estimates across individual scales and composite scores were medium to large, ranging from $d = -.56$ to $d = 1.24$.

Table 5.3

Interpersonal Social Behaviour Problem Outcomes of Methadone-Exposed and Non-Exposed Comparison Children at Age 9.5 Years

BASC-2 Scale Scores	Methadone Group ($n = 75$)	Comparison Group ($n = 96$)	χ^2/t	p	$d(95\% \text{ CI})$
<i>M (SD)</i> Social Skills	45.24 (9.10)	54.78 (8.64)	-7.00	< .001	1.08 (0.75, 1.40)
% (n) at-risk range ^b	21.3 (16)	6.3 (6)	8.55	.003	-
% (n) clinically significant range ^c	4.0 (3)	0 (0)	3.91	.048	-
<i>M (SD)</i> Withdrawal ^a	54.89 (12.09)	48.50 (11.00)	3.61	< .001	-0.56 (-0.86, -0.25)
% (n) at-risk range ^d	29.3 (22)	11.5 (11)	8.64	.003	-
% (n) clinically significant range ^e	10.7 (8)	5.2 (5)	1.79	.181	-
<i>M (SD)</i> Functional Communication	41.76 (8.82)	52.95 (9.19)	-8.04	< .001	1.24 (0.91, 1.57)
% (n) at-risk range ^b	36.0 (27)	7.3 (7)	21.78	< .001	-
% (n) clinically significant range ^c	8.0 (6)	3.5 (3)	2.01	.157	-
<i>M (SD)</i> Emotional Self-Control ^a	56.64 (11.64)	48.24 (9.26)	5.12	< .001	-0.81 (-1.12, -0.50)
% (n) at-risk range ^d	25.3 (19)	4.2 (4)	16.21	< .001	-
% (n) clinically significant range ^e	8.0 (6)	3.1 (3)	2.01	.157	-

Note. ^a Higher scores are indicative of problem behaviour; ^b T -score of 31 – 40; ^c T -score of < 30; ^d T -score of 60 – 69; ^e T -score of > 70; d = Cohen's d effect size; CI = confidence interval.

5.4 Development of a Composite Measure

In order to conduct further analyses, such as the examination of group differences on measures of social competence while statistically controlling for potential effects of infant, child and socio-familial characteristics, the formation of an interpersonal social behaviour composite measure was required.

To create the interpersonal social behaviour composite measure, variables considered conceptually relevant were entered into a correlation matrix. Significantly correlated variables were retained and identified as possible measures to be included into the composite measure. Confirmatory Factor Analysis (CFA) was then conducted to ensure each variable identified was contributing meaningfully to the composite. Finally the interpersonal social behaviour composite was created. First, variables with negative loadings were identified and reverse scored. Second, individual variables were then transformed into z-scores. Third, the composite was created by summing conceptually and statistically relevant variables. Fourth, the summed total score was divided according to the number of variables in the composite. The composite measure had a mean of 0 and a standard deviation of 1.

5.5 Composite Measure of Interpersonal Social Behaviour

The rate of interpersonal social behaviour problems was predicted to be a contributing factor for social competence as part of the hypotheses for the current study. The following four variables drawn from the BASC-2 were considered conceptually relevant to interpersonal social abilities: the social skills adaptive scale, the withdrawal clinical scale, the functional communication adaptive scale, and the emotional self-control content scale (see Figure 5.1). All subscales were moderately inter-correlated with one another ($r = .37$ to $.63$). CFA was conducted to test whether these subscales measure the same underlying construct. If so, a composite of these four subscales could be used as a measure of interpersonal social behaviour.

SOCIAL COMPETENCE OF METHADONE-EXPOSED CHILDREN

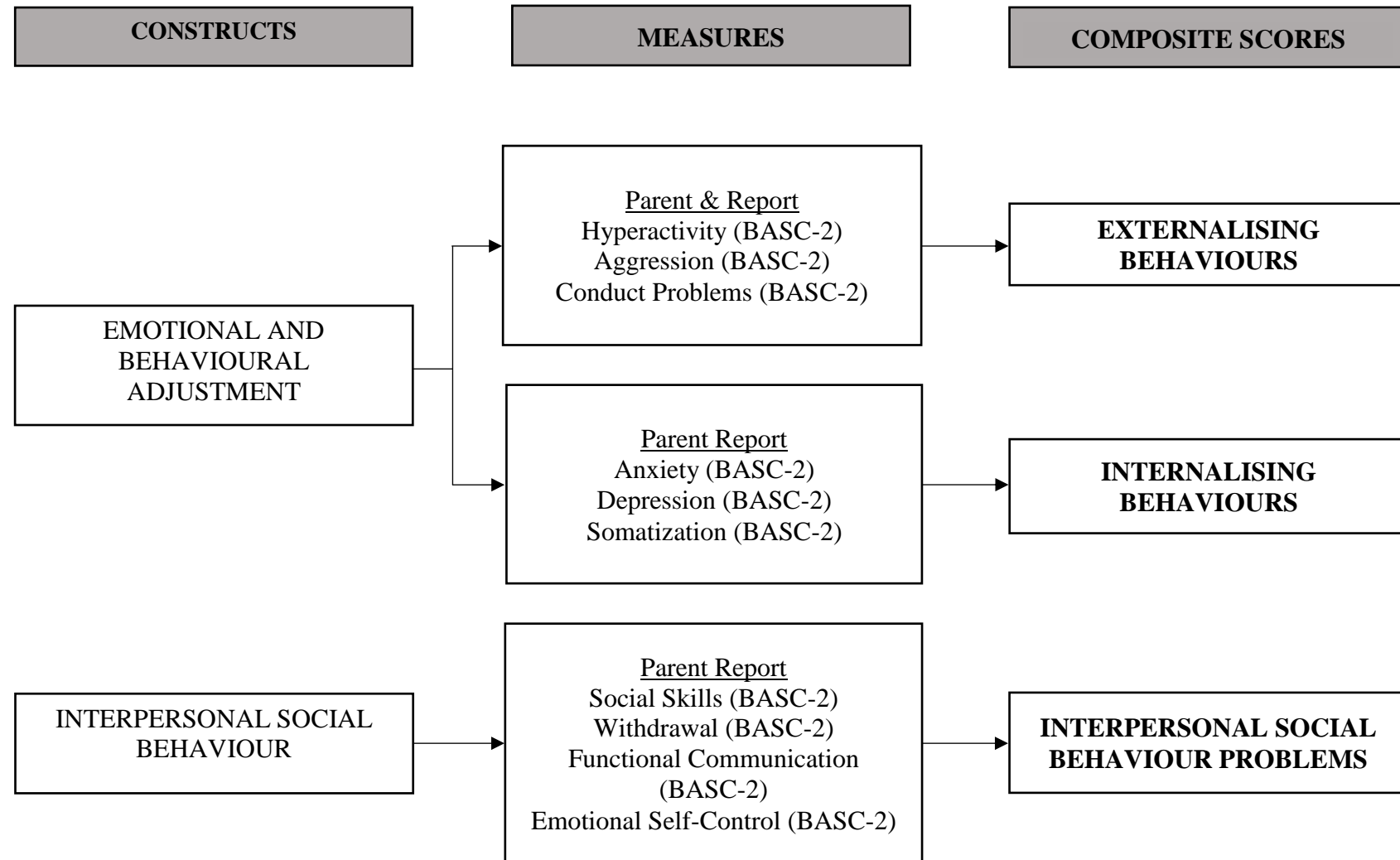


Figure 5.1. Flow Chart Summarising the Developmental Measures of Social Competence

The proposed composite was evaluated using the statistical programme IBM SPSS AMOS, version 25. The dataset was complete with no missing values. The four subscales fitted well to a single underlying factor model, supporting the validity of using a single composite measure to represent them $\chi^2 (2) = 2.011, p = .366, RMSEA = .006, CFI = 1.000$. The composite measure was internally consistent with an obtained Cronbach Alpha of 0.78. Figure 5.2 illustrates the CFA model tested.

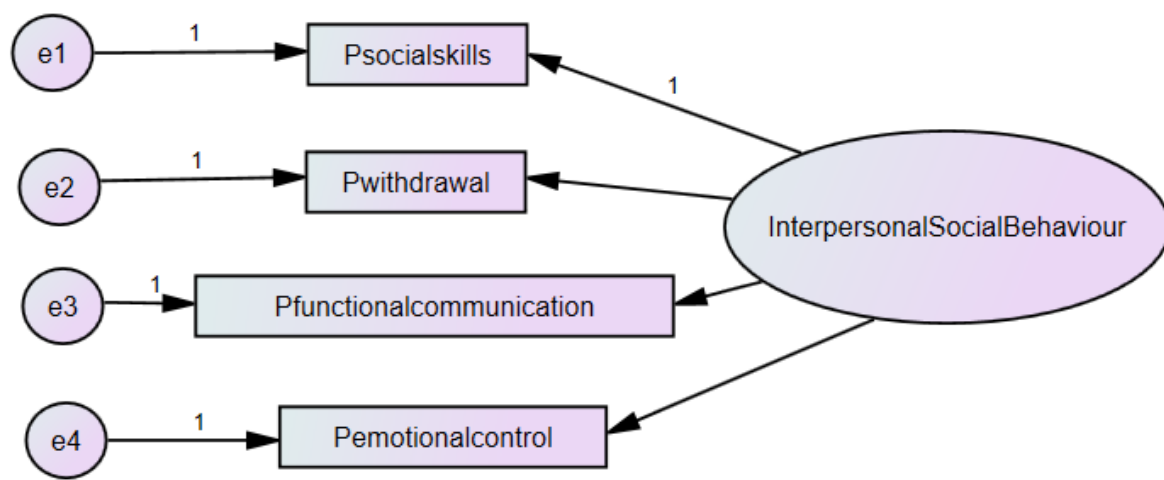


Figure 5.2. Proposed and Accepted CFA Model of Interpersonal Social Behaviour

Table 5.4 shows the individual factor loadings for each subscale. Loadings range from .58 - .86. Based on these results, after reverse scoring positively coded items, the four subscales were summed to create a composite measure of interpersonal social behaviour.

Table 5.4

Confirmatory Factor Analysis Standardised Individual Factor Loadings for the Interpersonal Social Behaviour Composite

Scales	Loading
BASC-2 Withdrawal	-.58
BASC-2 Social skills	.73
BASC-2 Functional communication	.86
BASC-2 Emotional self-control	-.60

An independent means *t*-test was used to test for difference in the rate of interpersonal social behaviour problems, as measured by the created composite, between ME and non-ME children at age 9.5 years old (see Table 5.5). ME children were rated by caregivers as displaying increased levels of interpersonal social behaviour problems compared with non-ME children ($M_{ME} = -.36$, $SD_{ME} = .63$, $M_{non-ME} = .46$, $SD_{non-ME} = .70$; $t(169) = 8.08$, $p < .001$). The standardised magnitude of the difference between ME and non-ME children on this measure was large, Cohen's $d = -1.25$, $CI = (-1.57, -.091)$.

The presence of at-risk and clinically significant levels of interpersonal social behaviour problems was calculated using similar cut off criteria used for the externalising and internalising behaviour BASC-2 composites. Children who scored in the at-risk range for maladaptive interpersonal social behaviours received scores between one and two standard deviations above the overall interpersonal social behaviour composite mean (.78 to 1.56). Children who scored in the clinically significant range received scores two standard deviations or more above the overall composite mean (> 1.57).

A higher proportion of ME children (24%) scored in the at-risk range than non-ME children (4.2%, $p < .001$). Additionally, a higher proportion of ME children (6.7%) received scores placing them in the clinically significant range, compared with none of the non-ME children ($p = .010$). These findings suggest ME children display heightened levels of maladaptive interpersonal social behaviour problems as rated by their caregivers.

Table 5.5

Interpersonal Social Behaviour Composite Outcomes of Methadone-Exposed and Non-Exposed Comparison Children at Age 9.5 Years

Composite	ME (<i>n</i> = 75)	Non-ME (<i>n</i> = 96)	χ^2/t	<i>p</i>	<i>d</i> (95% CI)
<i>M</i> (<i>SD</i>) Interpersonal Social Behaviour	.46 (.70)	-.36 (.63)	8.08	< .001	-1.25 (-1.57, -0.91)
% (<i>n</i>) at-risk range	24.0 (18)	4.2 (4)	14.77	< .001	-
% (<i>n</i>) clinically significant range	6.7 (5)	0.0 (0)	6.59	.010	-

Note. *d* = Cohen's *d* effect size; CI = confidence interval.

5.6 Clinical and Socio-Familial Predictors of Social Competence of Children Prenatally

Exposed to Methadone and Non-Exposed Comparison Children at Age 9.5 Years

Linear regression analyses were conducted to examine the degree to which outcomes for domains of social competence were explained by confounding factors independent of methadone exposure. First, possible confounding factors were identified from the larger study database and examined in a correlation analysis. The selection of factors was based on prior research and theory of the socio-familial differences between drug using and non-drug using families. Infant variables entered include birth weight, head circumference, gender, group status, and other drug exposure. Socio-familial variables entered included the socio-familial risk composite, maternal mental health at term, and number of primary caregiver changes to age 9.5 years. Variables significantly correlated ($p < .05$) with an $r > .3$ were retained for further analysis.

Table 5.6 shows the results of correlation analyses. Several socio-familial measures were significantly correlated with outcomes for domains of social competence at age 9.5 years. Correlated measures subsequently retained for further analysis include: the socio-familial risk composite, maternal mental health score, total number of primary caregiver changes experienced by 9.5 years, and other prenatal drug exposure.

Table 5.6

Correlation Matrix of Potential Covariates for Domains of Social Competence at Age 9.5 Years

	ISBP Composite	EXT Composite	INT Composite	Methadone Exposure	Birth Weight	Head Cir.	Gender	Social Risk	No. Caregiver Changes	Mental Health	Other Drugs
ISBP	1										
EXT	.738**	1									
INT	.564**	.399**	1								
Methadone Exposure	-.528**	-.502**	-.251**	1							
Birth Weight	-.184*	-.167*	-.079	.313**	1						
Head Cir.	-.182*	-.136	-.092	.290**	.705**	1					
Gender	-.179*	-.077	.017	.127	-.010	-.088	1				
Social Risk	.472**	.434**	.249**	-.629**	-.175*	-.179*	-.025	1			
No. Caregiver Changes	.466**	.457**	.180*	-.545**	-.244**	-.258**	-.013	.409**	1		
Mental Health	.484**	.446**	.268**	-.522**	-.147	-.150	-.138	.495**	.370**	1	
Other Drug	.410**	.399**	.162*	-.721**	-.267**	-.247**	-.056	.535**	.489**	.474**	1

Note. Pearson r correlations used; $p < .05^*$; $p < .001^{**}$; ISBP = interpersonal social behaviour; EXT = externalising behaviour; INT = internalising behaviour; Cir. = circumference; No. = number.

5.6.1 Predictors of Externalising Behaviour in Children Prenatally Exposed to Methadone and Non-Exposed Comparison Children at Age 9.5 Years. Table 5.7 shows regression analyses for the externalising behaviour composite. Methadone exposure explained a significant proportion of the variance in externalising behaviours in Model 1 ($\beta = -.50, p < .001$), explaining 25% of externalising behaviours. After entering the following covariates: social risk, other drug exposure, number of primary caregiver changes, and maternal mental health, methadone exposure remained a significant covariate of externalising behaviours ($p = .038$). In Model 2 methadone exposure decreased from $\beta = -.50$ (in Model 1) to $\beta = -.22$. Covariates found to be significantly associated with externalising behaviours were methadone exposure ($\beta = -.22, p = .038$), number of primary caregiver changes until 9.5 years ($\beta = .21, p = .008$), and maternal mental health at term ($\beta = .21, p = .009$). After inclusion of socio-familial covariates in Model 2, the total variance explained was 33%, $F(5, 169) = 16.48, p < .001$. The inclusion of covariates explained an additional 8% of the variance in externalising behaviour, $R^2 \text{ change} = .09, F \text{ change}(4, 164) = 5.33, p < .001$.

These findings show prenatal methadone exposure is not solely responsible for the elevated rates of externalising behaviours at age 9.5 years, as other socio-familial risk factors present during pregnancy and through childhood also contribute to the elevated rates of externalising behaviours.

Table 5.7

Externalising Behaviour Outcomes after Adjusting for Confounding Factors

Variable	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Model 1 - Unadjusted				
Methadone Exposure	-11.11	1.50	-.50	< .001
$^aF(1, 169) = 55.30, p < .001, R^2 = .25, \text{Adjusted } R^2 = .24$				
Model 2 – Adjusted				
Methadone Exposure	-4.94	2.37	-.22	.038
Social Risk	.93	.66	.12	.159
Other Drug Exposure	-.16	.64	-.02	.810
Number Caregiver Changes	1.73	.65	.21	.008
Mental Health	.35	.13	.21	.009
$^aF(5, 169) = 16.48, p < .001, R^2 = .33, \text{Adjusted } R^2 = .31$				

Note. ^a model change *F*s.

5.6.2 Predictors of Internalising Behaviour in Children Prenatally Exposed to

Methadone and Non-Exposed Comparison Children at Age 9.5 years. Table 5.8 shows regression analyses for the internalising behaviour composite. Methadone exposure singularly explained 6% of the variance in internalising behaviours in Model 1 ($\beta = -.24, p < .001$). After controlling for social risk, other drug exposure, number of primary caregiver changes, and maternal mental health; methadone exposure was no longer significantly associated with internalising behaviour outcome ($\beta = -.14, p = .038$). In Model 2 methadone exposure decreased from $\beta = -.24$ (in Model 1) to $\beta = -.14$. No socio-familial factors entered in the model were significant predictors of internalising behaviours, however maternal mental health approached significance ($\beta = .18, p = .054$). After inclusion of socio-familial covariates in Model 2, the total variance explained was 10%, $F(5, 169) = 3.55, p = .004$. The inclusion of covariates explained an additional 4% of variance in internalising behaviours, R squared change = .04, F change (4, 164) = 1.73, $p = .146$.

These findings show prenatal methadone exposure alone does not account for the heightened presentation of internalising behaviours at age 9.5 years. Other covariates

associated with methadone group membership not included in the proposed model may account for higher levels of internalising behaviours.

Table 5.8

Internalising Behaviour Outcomes after Adjusting for Confounding Factors

Variable	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Model 1 - Unadjusted				
Methadone Exposure	-6.04	1.85	-.24	< .001
^a <i>F</i> (1, 169) = 10.65, <i>p</i> < .001, <i>R</i> ² = .06, Adjusted <i>R</i> ² = .05				
Model 2 – Adjusted				
Methadone Exposure	-3.35	3.05	-.14	.274
Social Risk	.94	.85	.11	.272
Other Drug Exposure	-.75	.82	-.10	.361
Number Caregiver Changes	.37	.84	.04	.664
Mental Health	.33	.17	.18	.054
^a <i>F</i> (5, 169) = 3.55, <i>p</i> = .004, <i>R</i> ² = .10, Adjusted <i>R</i> ² = .07				

Note. ^a model change *F*s.

5.6.3 Predictors of Interpersonal Social Behaviour in Children Prenatally Exposed to Methadone and Non-Exposed Comparison Children at Age 9.5 years. Table 5.9 displays regression analyses for the Interpersonal Social Behaviour composite. Methadone exposure explained 27% of the variance in interpersonal social behaviour problems in Model 1 ($\beta = -.53$, $p < .001$). After controlling for social risk, other drug exposure, number of primary caregiver changes, and maternal mental health, methadone exposure remained a significant covariate of interpersonal social behaviour in Model 2 ($\beta = -.23$, $p = .025$). In Model 2 methadone exposure decreased from $\beta = -.53$ (in Model 1) to $\beta = -.23$. Covariates found to be significantly associated with interpersonal social behaviour problems were methadone exposure ($\beta = -.23$, $p = .025$), number of primary caregiver changes until 9.5 years ($\beta = .21$, $p = .006$), and maternal mental health at term ($\beta = .24$, $p = .002$); social risk approached significance ($\beta = .15$, $p = .067$). After inclusion of the socio-familial covariates into the model, Model 2 explained 38% of the variance in interpersonal social behaviour problems, *F* (5, 169) = 19.97, $p < .001$. The inclusion of covariates into the model explained an additional

11% of interpersonal social behaviour, R squared change = .11, F change (4, 164) = 6.94, $p < .001$.

These findings show prenatal methadone exposure is not solely responsible for the elevated rates of interpersonal social behaviour problems in methadone-exposed children at age 9.5 years, as other socio-familial risk factors also predict elevated rates of interpersonal social behaviour problems.

Table 5.9

Interpersonal Social Behaviour Outcomes after Adjusting for Confounding Factors

Variable	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Model 1 - Unadjusted				
Methadone Exposure	-.81	.10	-.53	<.001
^a F (1, 169) = 63.16, $p < .001$, $R^2 = .27$, Adjusted $R^2 = .27$				
Model 2 – Adjusted				
Methadone Exposure	-.36	.16	-.23	.025
Social Risk	.08	.04	.15	.067
Other Drug Exposure	-.02	.04	-.05	.567
Number Caregiver Changes	.12	.04	.21	.006
Mental Health	.03	.01	.24	.002
^a F (5, 169) = 19.97, $p < .001$, $R^2 = .38$, Adjusted $R^2 = .36$				

Note. ^a model change F s.

CHAPTER 6

Discussion

Opiate drug use during pregnancy is an increasing global health concern. Prenatal exposure to licit and illicit substances is associated with a wide range of adverse neurological and developmental outcomes including growth restrictions, poor motor coordination, cognitive delay, and behavioural adjustment difficulties (de Cubas & Field, 1993; Hunt et al., 2008; Rosen & Johnson, 1982; Straus et al., 1998; Wilson et al., 1981). Presently, methadone substitution treatment is one of the treatment options available for pregnant opiate-dependent women in New Zealand (Adamson et al., 2012; Ministry of Health, 2014). While methadone treatment during pregnancy has numerous benefits for the mother and her unborn baby

(Cleary et al., 2012; Deering et al., 2008; Farid et al., 2008; Finnegan, 1978; Johnson et al., 2003; Joseph et al., 2000) the long term impact of prenatal methadone exposure on child developmental outcomes remains unclear.

To date, there is no research examining the social competence of prenatally methadone-exposed school-aged children. Research in this area is important as social competence plays a crucial role in an individual's present and future functioning (Rose-Krasnor, 1997). For example, considerable evidence indicates the level of social competence held by an individual can influence the quality and success of peer interactions, academic success, mental health outcomes, employment opportunities and later intimate relationships (Domitrovich et al., 2017; Moffitt et al., 2011; Rose-Krasnor, 1997; Woodward & Fergusson, 2000). Additionally, during adolescence having a high level of social competence can aid in the avoidance of delinquent and risk taking behaviours, such as aggressive acts and substance use, and increase the display of socially appropriate behaviour (Domitrovich et al., 2017; Moffitt et al., 2011).

Existing research suggests a strong association between at risk individuals, such as individuals with high levels of behavioural dysregulation or those who are exposed to psychosocial risk, and the protective properties of interpersonal competencies, whereby individuals with high interpersonal competence evidence better outcomes later on in life (Elias & Haynes, 2008; Jones et al., 2015). This association is demonstrated in a longitudinal study investigating teachers ratings of their ethnically diverse, low income students level of interpersonal competencies during kindergarten on later adult outcomes (Jones et al., 2015). Study findings showed higher levels of competence were associated with a reduction in likelihood of receiving state assistance and engaging in criminal activity and substance use. Further, adults who received higher ratings of interpersonal competencies when in kindergarten were more likely to maintain stable employment at age 25 (Jones et al., 2015).

Elias and Haynes (2008) and Jones et al. (2015) findings when considered in relation to prenatal methadone exposure raise additional concerns as methadone-exposed (ME) children are a dual-hazard at risk population, for example experiencing both psychosocial adversity and prenatal drug exposure. Additionally, existing research shows children prenatally exposed to opiates, such as heroin, are at increased risk of emotional and behaviour adjustment difficulties (Bada et al., 2012; de Cubas & Field, 1993; Nygaard et al., 2016; Ornoy et al., 2001; Soepatmi, 1994; Walhovd et al., 2007). Social competencies are crucial for optimal development and in lessening negative effects from exposure to risk (Domitrovich et al., 2017) therefore it is critical to identify the association between prenatal methadone exposure and children's behavioural competencies to determine appropriate supports for this population.

To date, the current study is the first research investigation to assess the social competence of school-aged children born to mothers maintained on methadone during pregnancy. Findings from the current study provide compelling evidence to suggest that ME children's social competence is poorer when compared to their non-exposed (non-ME) peers. The current study aimed to address the gap in research on prenatal methadone exposure and the effects on child social competence by comparing the social competencies of children born to mothers in methadone maintenance treatment with comparison children born to non-opiate-using mothers at age 9.5 years. An additional aim was to assess the effect of psychosocial risk factors including low socio-economic status, caregiver instability, maternal psychiatric status, and poly-drug exposure, on child social competence domain outcomes. It was hypothesised that prenatal methadone exposure would predict poorer social competence over and above the effects of psychosocial risk factors.

6.1 Behavioural Adjustment Outcomes

There is a robust body of research describing elevated levels of behaviour problems in children who have been prenatally exposed to opiates; typically studies report elevated rates of hyperactivity, conduct problems, impulsivity, somatisation, aggression, and inattention (Bada et al., 2012; de Cubas & Field, 1993; Nygaard et al., 2016; Ornoy et al., 2001; Soepatmi, 1994; Walhovd et al., 2007). To date, only one study has examined the social development of school-aged children prenatally exposed to methadone (de Cubas & Field, 1993), with findings reflecting those reported for the wider opiate-exposed population.

The present study examined the emotional and behavioural adjustment competencies, specifically the externalising and internalising behaviours, reported by caregivers of 9.5 year old ME and non-ME children. The first hypothesis that ME children would have poorer outcomes on domains of social competence when compared to non-ME children was supported. ME children were found to exhibit higher levels of both externalising and internalising behaviours compared to non-ME children. Specifically, ME children display heightened levels of hyperactivity, aggression and conduct problems, and had greater depression symptomatology. These results are consistent with the findings of Bada et al. (2012), de Cubas and Field (1993), Nygaard et al. (2016), and Ornoy et al. (2001) who found opiate-exposed children evidenced greater difficulty in the display of socially appropriate behaviour. For example, when comparing the behavioural adjustment of 20 ME and 20 non-ME children between six and 13 years, ME children were reported to have heightened levels of externalising, internalising, depressive, hyperactive, aggressive, and somatisation difficulties on scales of the Child Behaviour Checklist (CBCL; de Cubas & Field, 1993). In contrast to the previously reported studies and findings from the present study, Walhovd et al. (2007) did not find significant differences in the externalising behaviour of prenatally opiate-exposed children and non-exposed comparison children. However, these findings may be

explained in part by Walhovd et al.'s (2007) small sample size, as significant group differences were obtained in a later study which drew from the same population pool as Walhovd et al. (2007) with less stringent inclusion criteria (Nygaard et al., 2016).

Socially competent children possess behaviours which allow them to function effectively in social settings (Cavell, 1990; Ritchie et al., 2015; Rose-Krasnor, 1997). Examples of social competencies include the ability to moderate one's emotions and behaviours when provoked, active participation in social interactions, and being social responsive, considerate, and flexible (Halle & Darling-Churchill, 2016; Han & Kemple, 2006; Rose-Krasnor, 1997). Findings from the current study suggest that nearly 40% of the ME group children do not possess behavioural competencies indicative of high levels of social competence. This is demonstrated by caregivers reporting ME children display higher levels of aggression, hyperactivity, and conduct behaviours than non-ME children.

While ME children were reported to have poorer emotional and behavioural adjustment competencies compared to non-ME children, the level of behaviour was within the average range of the BASC-2 normative data scores. Additional analyses revealed further group differences whereby a larger proportion of ME children met criteria for at-risk and clinically significant levels of externalising behaviour, and clinically significant levels of internalising behaviour. Indicating that while the majority of the ME children achieve scores in the normal range, many ME children are characterised by high levels of disruptive externalising and internalising behaviours. This is of concern as the presence of internalising symptomatology has been identified to adversely affect the development of peer relationships (Kamphaus, DiStefano, & Lease, 2003). Direct comparison of these findings with existing research is difficult given only one of the studies reviewed earlier in this thesis included clinical cut-offs (Soepatmi, 1994). Despite this, current study findings provide further support for the heightened display of behavioural problems in children prenatally exposed to methadone.

Using the CBCL, Soepatmi (1994) reported that a higher proportion of heroin and heroin/methadone-exposed children scored above the 90th percentile (10% of the reference group) for total problem behaviour scores. Thus a large number of prenatally drug-exposed children in Soepatmi's (1994) study had elevated levels of behaviour problems in the clinical range, which in turn may affect their ability to function effectively in social situations.

Emotional adjustment is an important competency of social competence. Of interest, ME and non-ME children received similar scores on anxiety and somatization behaviours. The proportion of children scoring in the at-risk range on the internalising composite was also similar. A possible explanation for the lack of difference between the groups may be due to the BASC-2 screening system. Despite the BASC-2 having been shown to demonstrate high validity in mainstream populations, recent research suggests it may not adequately measure the presence of internalising symptomatology in at risk populations (Bender, Auciello, Morrison, MacAllister, & Zaroff, 2008).

Bender et al. (2008) examined the convergent validity of the CBCL and BASC-2 in their sample of individuals with epilepsy. They reported discrepancies between the two screening systems in which the CBCL identified a larger proportion of participants scoring in the at-risk and clinical range for internalising behaviour problems. Specifically, the CBCL captured a larger number of participants demonstrating clinical levels of depressive, anxious, and somatising symptomatology than the BASC-2. These findings suggest the CBCL has greater sensitivity in measuring internalising and affective symptomatology within at risk populations which may account for reported differences between opiate-exposed and non-exposed children's internalising symptomatology scores (see de Cubas & Field, 1993; Nygaard et al., 2016; Ornoy et al., 2001; Soepatmi, 1994). It is possible greater internalising symptomatology scores may have been obtained by ME children than non-ME children if an alternative screening system, such as the CBCL, had been used in the current study.

6.2 Interpersonal Social Behaviour Problem Outcomes

Previous research reports consistent associations between prenatal opiate exposure and poor social interactive competencies tracking across infancy, toddlerhood, and during the school years (de Cubas & Field, 1993; Hunt et al., 2008; Nygaard et al., 2016; Soepatmi, 1994; Walhovd et al., 2007). Poor social interactive behaviour can include poor social skills, heightened withdrawal, increased peer related problems, and social rejection. Research within this area has yet to be conducted with school-aged ME children, consequently the effects of prenatal methadone exposure on interpersonal social competencies remains unknown.

Caregivers reported that ME children exhibit higher levels of interpersonal social behaviour difficulties than non-ME children. ME children were rated as more withdrawn, with lower levels of social skills, functional communication, and emotion control. These findings suggest that some ME children are at a greater risk of having levels of interpersonal social competencies inadequate to effectively participate in social settings. For example, the findings from the current study imply ME children are less likely to use manners, encourage others, and offer assistance to those in need than their non-exposed peers. This is of concern as poor interpersonal social competencies can impact on the formation and maintenance of peer relationships and how the individual is perceived and treated by teachers, parents, peers and society (Rose-Krasnor, 1997), resulting in disengagement, non-compliance and social isolation (Rubin & Mills, 1988).

Findings from the current study are consistent with existing research in which opiate-exposed children have been found to display poor interpersonal social competencies, shown through higher rates of social problems and greater difficulties in their social interaction and social functioning abilities compared with non-exposed children (de Cubas & Field, 1993; Nygaard et al., 2016; Soepatmi, 1994; Walhovd et al., 2007). For example, both Nygaard et

al. (2016) and Walhovd et al. (2007) identified higher scores on the social problems subscale of the CBCL in opiate-exposed children than in non-exposed children.

Despite the findings of the current study that the majority of ME children possessed an average level of interpersonal social competency suitable for successful social interactions, one third of ME children were reported to lack the ability to participate effectively. This was demonstrated though a higher proportion of ME children meeting criteria for at-risk and clinically significant levels of maladaptive interpersonal social behaviours. Findings from the current study are consistent with results obtained from Soepatmi's (1994) study where more heroin and heroin/methadone-exposed children scored in the 90th percentile on total social competence. These findings come together to suggest opiate-exposed children are at an increased risk for display of high levels of negative social behaviours including anti-social tendencies, poor listening, bad manners, and non-compliance than non-exposed children.

6.3 Summary of Social Competence

The current study suggests children with prenatal exposure to methadone are at increased risk of poorer social competence at age 9.5 years compared to their non-exposed peers. Difficulties in emotional and behaviour adjustment competencies included increased rates of hyperactivity, aggression, conduct problems, and depressive symptomatology. Interpersonal social competency difficulties spanned functional communication, emotional regulation, withdrawal, and social skills. Together these findings suggest low levels of social competence in ME children.

ME children with poor social competence may be at increased likelihood of being perceived as an inconvenience and a nuisance across multiple settings, for example in school and home environments. Within educational settings these children may frequently interrupt others and disturb the flow of the classroom learning environment. This in turn may result in teachers viewing these children as an inconvenience and a hindrance in the academic

development of other children present in the classroom. This perception may consequently affect the teacher's behaviour towards the child. Within the home environment constant chaos and frequent interruptions may result in caregivers feeling overwhelmed with their children's developmental needs. Research suggests parents who perceive their children's misbehaviour as intentional actions show increased levels of hostility and discipline and lower levels of warmth in their parenting practices (Slep & O'leary, 1998; Wang, Deater-Deckard, & Bell, 2013) which can disturb the formation of positive caregiver-child relationships, a characteristic shown to be associated with social competence (Kopala-Sibley et al., 2012; Maccoby & Martin, 1983; Rispoli et al., 2013). Lastly, in peer relationships, children who show increased levels of social abhorrent behaviours are less likely to form positive friendships and are more likely to experience increased rejection.

Collectively, findings from the current study highlight the importance of implementing a broad and integrated approach when measuring the construct of social competence. Examination of a single domain of social competence may underestimate the association of prenatal methadone exposure and increased risk of social difficulties. By employing a broader conceptual framework of social competence through examination of multiple competencies, rather than focusing on a singular domain, the present study offers a unique and in-depth insight into the social competencies of ME school-aged children. This broader assessment of social competence permitted the finding that while some ME children have adequate levels of social competence; other ME children do not, evidenced through high levels of externalising, internalising, and interpersonal social problem behaviours on composite measures. Findings from the current study highlights an important issue, that of the potential effects risk factors associated with methadone group membership may have on children's social competence.

6.4 Socio-familial Risk Factors

The second aim of the current thesis was to identify psychosocial factors that may place ME children at increased risk of poor social competence at 9.5 years of age. Four psychosocial risk factors were associated with poorer social competence outcomes at 9.5 years of age, including high levels of socio-familial risk, maternal depressive symptomatology at the time of their child's birth, poly-drug use and the number of caregiver changes experienced by age 9.5 years. Following adjustment for psychosocial risk factors three factors were predictive of externalising behaviour and interpersonal social behaviour competencies: prenatal methadone exposure, number of primary caregiver changes and maternal depressive symptomatology.

A positive linear relationship was identified between the number of primary caregiver changes experienced and increased levels of externalising behaviour and interpersonal social behaviour difficulties at age 9.5 years. Specifically, higher rates of caregiver changes were associated with increased behaviour difficulties. This is consistent with findings from existing research with mainstream and opiate-exposed children living in unstable households, in which higher rates of externalising behaviours, internalising behaviours, and prosocial behaviour difficulties are reported (Bada et al., 2008; Claessens & Chen, 2013; Lean, Pritchard, & Woodward, 2013; Pilarz & Hill, 2014; Rubin, O'Reilly, Luan, & Localio, 2007).

Increased monitoring of opiate-dependent mothers can result in higher rates of contact with child protective services, often leading to the removal of children from opiate-dependent mothers (Bada et al., 2008; Hunt et al., 2008; Lean et al., 2013). In their sample of 1,092 opiate-dependent mothers, Bada et al. (2008) reported that 35% of such mothers had lost custody of their children by age three years. Similarly, Ornoy et al. (2001) reported that over half of their sample of children born to heroin-dependent mothers were removed from the maternal home by age six years ($n = 339$). While removal from the maternal home can lead to

improvements in a child's nutrition, home environment, and overall quality of life, caregiver instability can act as an additional stressor, leading to feelings of uncertainty and impermanence for the child (Pilarz & Hill, 2014). This in turn, can affect the formation of safe, positive, and secure caregiver-child relationships which are associated with decreased levels of behavioural adjustment problems (Claessens & Chen, 2013; Pilarz & Hill, 2014). Collectively, these findings suggest that frequent change in caregiving arrangements is one potential mechanism leading to high levels of behavioural adjustment difficulties present in ME children.

High levels of perinatal maternal depressive symptomatology were a significant predictors of externalising behaviour and interpersonal social behaviour difficulties when the children were age 9.5 years. This finding is consistent with research in the fields of both mainstream and prenatal drug-exposure where elevated levels of maternal and caregiver psychological distress is consistently linked to later childhood behavioural problems that is independent of drug use (Accornero et al., 2002; Bada et al., 2012; Choe et al., 2013; Sarfi et al., 2013). Increased maternal anxiety and depressive symptomatology can impact children's behavioural development through several mechanisms. These mechanisms include a genetic predisposition, exposure to stressful environments, disturbance in the parent-child relationship (Campbell et al., 2004; Choe et al., 2013) and experience of negative parenting behaviours (Kelley, 1992; Suchman & Luthar, 2000, 2001).

Psychosocial adversity characterised by the socio-familial risk index was not related to social competence. This finding is surprising as existing research has reported consistent associations between experience of social adversity and the display of behavioural difficulties (Bada et al., 2012; Eamon, 2001; Ornoy et al., 1996; Ornoy et al., 2001). Unfortunately there is no methadone exposure research with which to directly compare the current study's finding, as the one existing study matched participants on SES and did not consider other

socio-familial confounders (de Cubas & Field, 1993). It is possible a third intervening variable was present through which socio-familial risk exerts its influence, such as the quality of the parent-child relationship or parenting styles.

Existing research has highlighted that children born to methadone maintained mothers experience suboptimal parenting and parent-child interactions (Kelley, 1992; Suchman & Luthar, 2000, 2001). Specifically, methadone maintained mothers demonstrate less involvement and interest in their children (Suchman & Luthar, 2000, 2001) and display an increase in harsh, inconsistent, and neglectful parenting practices (Kelley, 1992; Suchman & Luthar, 2000). Further, low-SES, raising a child as a single parent and fewer years of secondary school education, together with high levels of depression and anxiety are all adverse factors that characterise families with a substance abusing parent (Bada et al., 2012; Davie-Gray et al., 2013; Johnson et al., 2003; Suchman & Luthar, 2001; Vucinovic et al., 2008). These characteristics are robustly associated with inconsistent, neglectful, and authoritarian parenting styles (Dawe, Harnett, Rendalls, & Staiger, 2003), which have been shown to be detrimental to a child's social development (Kopala-Sibley et al., 2012; Maccoby & Martin, 1983; Rispoli et al., 2013).

Rispoli et al. (2013) found that for two year old children poor attachment, impaired emotional control, low social competence and higher levels of negativity were associated with a lack of earlier parental responsiveness when the children were aged nine months. In another study Cole et al. (2003) reported increased levels of externalising behaviour problems in five year old children whose parents negatively responded to their distress with anger. Given the importance of parent-child interactions, together with the suboptimal parenting reported in methadone maintained mothers, it is possible that the effects of socio-familial risk are being masked by aspects of parenting.

A surprising finding that emerged from the current study was that psychosocial risk factors did not significantly contribute to internalising behaviour competencies after consideration of prenatal methadone exposure. Direct comparison of this finding is difficult as no past research exists examining this association in children prenatally exposed to methadone. However research with both opiate-exposed and mainstream children has consistently reported an association between these constructs and elevated rates of behaviour problems (Christensen & Bilenberg, 2000; Najman et al., 2004; Ornoy et al., 1996; Ornoy et al., 2001; Schneiders et al., 2003). A possible explanation for the non-significant association between psychosocial risk factors and internalising behaviours may be due to other intervening factors inherent to methadone maintained families. For example, experience of harsh and inconsistent parenting, poor parent-child relationships, and high rates of maternal depression and anxiety may contribute to the presentation of heightened levels of internalising symptomatology in children prenatally exposed to methadone.

Collectively, the current study has identified numerous social competence domains in which children prenatally exposed to methadone exhibit deficits compared with their non-exposed peers. Prenatal methadone exposure, maternal mental health and caregiver instability all independently contribute to children's social competence. Specifically, children born to mothers maintained on methadone throughout pregnancy who had poor mental health at the time of their child's birth and who experienced numerous caregiver changes were more likely to be rated by their primary caregiver as displaying higher levels of externalising and interpersonal social behaviour difficulties compared with children born to comparison mothers who had good mental health at the time of their child's birth and who live in a stable home environment. These findings highlight the importance of considering family and environmental factors when examining the presence of behaviour problems.

6.5 Strengths of the Current Study

The Christchurch Methadone in Pregnancy Study, from which the current study drew participants, has numerous strengths. Strengths include: a prospective and longitudinal design; strong initial recruitment; subsequent high retention rates; the use of a wide range of experimental measures; the availability of detailed child and family social demographic information and background; and the use of experimenters who were unaware of the children's group status. In addition, the current study examined multiple domains of social competence. Specifically, competencies relating to two distinct yet highly interrelated domains of social competence were examined, behavioural adjustment and interpersonal social behaviour.

The examination of two domains of social competence in the current thesis supports the conceptual model of social competence proposed by Hood (2009) who examined four domains of social competence including emotional regulation, behavioural adjustment, interpersonal social behaviours and social cognition, in four year old children who were born very preterm. Through the adoption of a broad, conceptual framework of social competence, Hood (2009) identified social competence difficulties in the domains of emotional regulation, externalising and internalising behaviours, and peer relationships. Additionally, Hood (2009) identified different infant clinical and socio-familial risk factors that impacted on each of these domains. The present study extends on these findings, providing additional support for the measurement of multiple domains in the examination of social competence. The acknowledgement and analysis of a wide range of abilities that impact on an individual's overall social competence allows for the identification and in-depth analysis of specific areas of difficulty. Further, this identification allows for targeted interventions, rather than those which target social capabilities as a whole.

6.6 Limitations of the Current Study

While the current study identified differences in the social competence of ME and non-ME children, there are several limitations important to note. First, the study relied solely on primary caregiver report, consequently findings should be interpreted cautiously. Parents may unwittingly be subject to reporter or desirability bias, through over or under reporting their children's behaviour problems, thereby affecting the reliability and validity of results. Additionally, caregivers who feel stressed or overwhelmed are at increased susceptibility of negative reporting biases (Vucinovic et al., 2008). Raising and caring for a child with behaviour problems can be a challenge as constant disciplining and correction of a defiant child can lead to increased stress levels for the caregiver. This may partially account for the increased rates of behaviour problems reported by caregivers of ME children. The inclusion of multiple informant measures of child behaviour, such as teacher report and observational research, has the potential to strengthen the association between prenatal methadone exposure and poor social competence at age 9.5 years.

A further limitation concerns participant retention and recruitment. While the Christchurch Methadone in Pregnancy Study has a large sample size and high retention rates in comparison to other opiate-exposed studies (Hunt et al., 2008; Rosen & Johnson, 1982; Soepatmi, 1994; Walhovd et al., 2007) it is possible children unable to be re-recruited for the 9.5 year follow-up represented families most at risk in both behaviour problems and psychosocial risk factors. If these children and their families had been successfully re-recruited poorer social competence outcomes may have eventuated. Despite this possibility, the high retention at follow-up of children born to methadone maintained mothers allows for the tentative generalisation of results to the wider New Zealand population of children prenatally exposed to methadone.

The internalising scale of the BASC-2 may be a limitation, as the BASC-2 may not adequately measure internalising symptomatology in at-risk populations (Bender et al., 2008). The CBCL was identified as an alternative screening system to the BASC-2 which may provide greater sensitivity in measuring internalising behaviour problems (Bender et al., 2008). It is possible that if an alternative measure was used, such as the CBCL, greater differences in internalising symptomatology between ME and non-ME children may have been identified.

A final limitation concerns data collection. Data were collected mainly by clinical psychologists and trained research assistants, who were naïve to the child's group membership, at the Canterbury Child Development House. However, in some circumstances, such as in the occasion of home assessments, it was not possible to remain naïve to the child's group membership. Possible observer bias effects may influence the administration and/or scoring for both ME and non-ME children if the scorer suspected a particular group membership. In an attempt to overcome this, in addition to remaining professional and consistent in the administration of tasks, scored data underwent frequent reliability checks through scoring from an independent individual.

6.7 Implications of the Current Study

Findings of the current study make a significant contribution to the limited existing research on long term developmental outcomes of children prenatally exposed to methadone. The current thesis presents findings about the social competencies of ME children aged 9.5 years. To the author's knowledge social competence has not been studied in children prenatally exposed to methadone, therefore the current study makes an important contribution to the prenatal methadone exposure literature, and provides new insight on the social competencies of ME children which may contribute to targeting interventions for this population.

The current study suggests that by age 9.5 years children born to mothers maintained on methadone throughout pregnancy experience greater difficulties across domains of social competence compared to their non-exposed peers. Specifically, ME children were found to have increased deficits in emotional and behavioural adjustment and interpersonal social competencies. This is of concern as impaired social functioning, such as the display of externalising and internalising behaviour, withdrawal, and poor emotion control predict social, academic and occupational functioning (Rose-Krasnor, 1997; Woodward & Fergusson, 2000) in addition to rates of delinquency, crime, violence, substance use, and depressive symptomatology (Fergusson, Woodward, & Horwood, 1999; Moffitt et al., 2011). Therefore it is vital that ME children and their families receive targeted interventions as early on in the child's life as possible to facilitate and improve children's social competencies. Additionally provision of treatment may help in the development of resilience and counteract the exposure to risk.

One intervention shown to be effective in reducing child behaviour problems is parenting programmes for primary caregivers (Dawe & Harnett, 2007; Dawe et al., 2003; Dawe, Harnett, Staiger, & Dadds, 2000). Parenting programmes should focus on the importance of forming positive caregiver-child relationships and provide training on how this can be achieved. In addition to parenting programmes, caregivers should be offered one on one support to identify and rectify areas of their own behaviour which could negatively impact their child's development, for example, continued substance abuse, affect dysregulation, and economic instability.

An additional intervention highly effective in fostering the development of social competencies in at risk children are child focused programmes, such as school-based interventions aimed at increasing children's social competencies (Domitrovich et al., 2017; Taylor, Oberle, Durlak, & Weissberg, 2017). For example, prosocial, social problem solving,

conflict resolution, and interpersonal relationship competencies. These programmes demonstrate decreased levels of aggression and disruptive behaviour post-programme, with positive effects remaining two years later, suggesting a durability in skills obtained overtime (Taylor et al., 2017). Additionally, children who participated in school-based programmes demonstrated increased academic success and display of positive social behaviours, and decreased engagement in drug use and emotional dysregulation (Domitrovich et al., 2017; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011)

In summary, the current study has identified deficits in the social competencies of ME children. These deficits place these children at risk of a detrimental developmental trajectory. It is important that comprehensive and long term interventions are provided to both ME children and their families in an attempt to reduce the harm of being born and raised in a substance abusing home.

6.8 Future Research

Findings from the current study offer a unique insight into the social competence of school-aged children prenatally exposed to methadone, however further research that addresses the identified limitations is required. Presently, there is limited research involving ME children, particularly beyond early childhood. Future research would benefit from the inclusion of a broader range of social competence domains, such as emotion regulation and social cognition. Additionally, the use of more in-depth competencies corresponding to each social competence domain, such as the examination of inhibitory and self-regulatory competencies related to behavioural adjustment, may offer more in-depth insights into the extent of ME children's specific social competencies and contribute to a better understanding into the distinct social competence deficits of ME children.

Future research should also include multiple informants. Inclusion of multiple informants increases the reliability and validity of findings and concurrently allows for the examination

of situational and pervasive difficulties. It is important to identify whether behavioural difficulties are limited to a specific setting, such as the home environment, or if difficulties extend into multiple settings, such as home and school environments. This identification would allow for the examination of environmental factors which may increase the likelihood of behaviour problems, concurrently allowing for targeted interventions in an attempt to decrease the prevalence of these behaviours.

Finally, numerous risk factors associated with being born to methadone maintained mothers not included in the current study may have important implications on the understanding of this population's developmental trajectory. Analysis of specific caregiving arrangements, primary caregiver's current mental health, parent-child relationships, and parenting practices may all provide additional insight into the association between prenatal methadone exposure and poor social competence outcomes. Additionally, inclusion of these risk factors may be useful for the identification of additional intervention programmes and policies targeted to optimise positive outcomes in this population.

6.9 Conclusion

Research examining the neurodevelopmental outcomes of ME children is critical in understanding the problems they experience as they grow up. Identification of areas of social competence in which ME children show vulnerability permits targeting of appropriate supports and interventions to attempt to reverse or inhibit the effects of prenatal methadone exposure on present and future functioning. Primary aims of the current study were to examine the social competence outcomes of ME children and compare these with non-ME children at age 9.5 years, and to identify early predictors of social competence. As hypothesised social competence difficulties were evident in ME children, who were showed deficits in behavioural adjustment and interpersonal social competencies than their non-

exposed peers. Three factors were predictive of these deficits: prenatal methadone exposure, caregiver instability, and maternal mental health at the time of their child's birth.

Findings from the current study raise concerns about the social competence of ME children as existing research indicates social competence is fundamental for developmental success (Ritchie et al., 2015; Rose-Krasnor, 1997), such as reducing delinquent and substance abusing behaviour, and improving mental health, academic, social, occupational outcomes (Domitrovich et al., 2017; Moffitt et al., 2011; Rose-Krasnor, 1997; Woodward & Fergusson, 2000). Thus indicating a critical need for provision of support and interventions for these children and their families. Early assistance is essential to prevent deficits in present and future functioning, as well as enabling these children to live a socially desirable and functional life.

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APPENDIX A

Canterbury Child Development
Research Group
Department of Psychology
College of Science



CODE NUMBER

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**9/ 10 YEAR FOLLOW-UP STUDY
CONSENT FORM**

- I have been invited to participate with my child in a study that is comparing the development of children who were and were not born to mothers on methadone maintenance during their pregnancy. I have read and understood the Information sheet dated November 2012.
- I have had enough time to consider whether we will take part in the study, and to discuss my decision with the researcher or a person of my choice.
- I know who to contact if I have any questions about the study.
- I understand that our participation in this research is **confidential** and that no material which could identify me will be used in any study reports, or made available to anyone else without my approval in writing.
- I understand my child will be videotaped during the procedure and that this information will only be used for further observation by the named investigators and the material will be secured and kept strictly confidential.
- I also understand that my child and I can withdraw from the study at any time.
- I understand the compensation provisions for the study.
- I am willing for the research team to contact my child's class teacher to obtain information on my child's school progress during the last year. YES/NO
- I agree to members of the research team having access to medical information about my child for cross checking the number and dates of any major or minor illnesses that I have recorded on the study forms. YES/NO
- I wish to receive a summary of the results of this study. YES/NO

I consent to take part in this study.

Parent/s Name: _____

Signature of Parent/s: _____ Date: _____

I consent to my child taking part in this study.

Child's name _____ Parent's Name: _____

Signature of Parent/s: _____ Date: _____

In my opinion, consent was given freely and the participant understands what is involved in this study.

Researcher's Name: _____

Signature of Researcher: _____ Date: _____

APPENDIX B



Health and Disability Ethics Committees
 1 the Terrace
 PO Box 5013
 Wellington 6011
 04 816 2403
 hdec@mh.govt.nz

28 November 2012

Dr Lianne Woodward
 Canterbury Child Development Research Group
 Psychology Department
 University of Canterbury
 Christchurch 8041

Dear Dr Woodward

Re:	Ethics ref:	URB/07/10/042
	Study title:	Neurodevelopmental Outcomes of Children Exposed to Methadone During Pregnancy at Ages 4.5 and 6 Years: Role of neuroanatomical and Socio-Environmental Factors.

I am pleased to advise that this amendment has been approved by the Southern Health and Disability Ethics Committee. This decision was made through the HDEC Expedited Review pathway.

Please don't hesitate to contact the HDEC secretariat for further information. We wish you all the best for your study.

Yours sincerely,

A handwritten signature in black ink, appearing to read "Raewyn Idoine".

Ms Raewyn Idoine
 Chairperson
 Southern Health and Disability Ethics Committee

Encl: appendix A: documents submitted
 appendix B: statement of compliance and list of members